

2008

Determining standard criteria for endotracheal suctioning in the paediatric intensive care patient: An exploratory study

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Determining Standard Criteria for Endotracheal Suctioning in the Paediatric Intensive Care Patient: An Exploratory Study.

A Thesis submitted in fulfilment of the requirements for the degree of

Masters by Nursing Research

School of Nursing, Midwifery & Postgraduate Medicine

Edith Cowan University, Western Australia

Kylie Davies BSc Nursing (RN), PG Cert (PIC), PG Dip (PIC)

September 2008

USE OF THESIS

The Use of Thesis statement is not included in this version of the thesis.

ABSTRACT

Endotracheal tube (ETT) suction is a common nursing procedure within the paediatric intensive care (PIC) setting. Significant side effects associated with this procedure can dramatically affect the stability of the critically ill ventilated paediatric patient. A comprehensive literature review failed to establish clear standards for determining when the procedure is warranted, especially in the paediatric population. This can present difficulty for the inexperienced paediatric intensive care nurse when assessing a patient's need for ETT suction.

The aim of the research was to design an evidence based endotracheal suction assessment tool (ESAT) for use by nurses caring for paediatric patients. The use of the ESAT aims to improve patient care within paediatric intensive care units by improving nursing practice for patients with an artificial airway in situ.

This four-phase study used both quantitative and qualitative methodological approaches. In Phase One a comprehensive literature review was performed to determine the most commonly used criteria for assessing the need for ETT suction. Identified criteria were then used to develop an Endotracheal Suction Questionnaire (ESQ) to survey experienced PIC nurses in Australia and New Zealand regarding their use of specified and non-specified criteria for the ETT suction decision making process. The questionnaire comprised 36 questions (8 demographic; 26 closed and visual analogue-type; 2 open-ended).

In Phase Two content validity, apparent internal consistency and clarity testing of the ESQ was undertaken with experienced PIC nurses (n=6) working in a tertiary paediatric intensive care unit. Thirty five of the 36 questions in the ESQ achieved preset criteria of 83% for clarity. All 36 questions achieved preset criteria for apparent internal consistency and content validity. Two questions were added to the ESQ based on suggestions from reviewers to specifically address additional issues considered relevant to the study.

In Phase Three, the ESQ was administered to 104 experienced PIC nurses in Australia (n=86) and New Zealand (n=18). Quantitative data from the ESQ was analysed using descriptive statistics and Spearman rank order correlation coefficients. Qualitative data was analysed using content analysis techniques. The key findings from the quantitative data results revealed two criteria were identified as "the most often used" with calculated means greater than 90. These were "suspected obstruction

of the endotracheal tube by secretions” and “visible or audible secretions”. The same two criteria for “rating of importance” had calculated means greater than 90. Eleven criteria ranged in value from M=86.4mm to M=64.4mm for “the most often used”. The same 11 criteria for “rating of importance” ranged in value from M=89.1mm to M=67.2mm. Two criteria had calculated means below 60 indicating a low importance to the respondents of the questionnaire for “the most often used”. These were “haemodynamics (unexplained changes in heart rate/BP & ICP if applicable)” and “frequency of endotracheal tube suction is set by unit protocol/guidelines”. These two criteria for “rating of importance” also had calculated means below 60, indicating a low importance to the respondents of the questionnaire.

Spearman rank order correlation coefficient analyses showed a positive correlation between the perceived frequency of use of a criterion and the appropriateness of the assessment. Higher ranked criterion had a lower correlation due to the smaller spread of results reflecting general agreement in their importance for both frequency and rating of importance. If the criterion was used less frequently as a clinical indicator for the requirement for endotracheal suction then participants had a lower regard for this when rating the criterion as a specific single indicator to perform suction.

The key finding from the qualitative results was the identification of six criteria not previously described within the literature but used within the clinical settings of both Australia and New Zealand PIC units. These were diagnosis, clinical history, previous response to ETT suction, clinical stability, current artificial ventilation mode and preparation for transport. Significantly the study results suggest that clinical assessment of the patient’s requirement for ETT suction is not defined by a single criterion but dependent on a number of interrelated factors. Importantly, ETT suction should only be performed based on the clinical condition and requirements of the individual patient, rather than standardised unit protocols or guidelines.

In Phase four, the empirical evidence generated from this study was used to develop an Endotracheal Suction Assessment Tool (ESAT). The design is based upon the criteria rated by nurses in this study as being most clinically important and essential during the decision making process.

Findings contribute to paediatric intensive care nursing theory and practice. Practice implications focus on the need for individualised assessment of the need for ETT suction according to a patient’s clinical condition. Further testing and validation

of the tool within the paediatric intensive care setting will determine the clinical viability of the ESAT and facilitate future research in this area.

DECLARATION

I certify that this thesis does not, to the best of my knowledge and belief:

- (i) incorporate without acknowledgement any material previously submitted for a degree or diploma in any institution of higher education.
- (ii) contain any material previously published or written by another person except where the reference is made in the text; or
- (iii) contain any defamatory material.

Signature: _____

Kylie Davies

September 25th, 2008

ACKNOWLEDGEMENTS

I wish to express my gratitude to the following people and organisations, which without their support my Masters project would not have been possible.

Firstly, I would like to express my sincere thanks to my very supportive husband whom without his encouragement and love this work would not have been completed.

I sincerely thank my principal supervisor, Associate Professor Leanne Monterosso whose unfailing support and guidance for my Masters Project and in relation to family issues was gratefully embraced. Thank you to Associate Professor Gavin Leslie whose insightful comments were of great assistance.

I sincerely thank Edith Cowan University for the opportunity and assistance to complete my Masters by Nursing Research.

I would like to acknowledge the assistance from Ms Laura-Clare Whelan and Rochelle Isles, Research Nurses at the Paediatric Intensive Care Unit (PICU) at the Starship Children's Hospital in New Zealand (NZ). A very special thanks to Laura for both guiding me through the NZ ethics application process long distance and for distribution of the Endotracheal Suction Questionnaire (ESQ) in New Zealand.

I would like to express my heartfelt thanks to Elaine Pascoe, Biostatistician at Princess Margaret Children's Hospital for her assistance in the development of the ESQ and in the statistical analysis phase of the research project.

I would like to thank the nursing staff in the PICU at Princess Margaret Children's Hospital who volunteered their time to assist in Phase Two of the research.

I would like to acknowledge and thank the Australian College of Critical Care Nurses
for the use of their data base for the distribution of the ESQ within Australia.

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CHAPTER 1

INTRODUCTION

1.1 Introduction

Airway management forms a crucial component in providing life support within the paediatric intensive care (PIC) setting (Curley & Moloney-Harmon, 2001; Mackway-Jones, Molyneux, Phillips & Wieteska, 2003). Advanced airway management can include invasive support measures such as the placement of an endotracheal tube (ETT) into a patient's airway to enable mechanical ventilation (Curley & Moloney-Harmon, 2001). When an ETT is in situ, a component of nursing care is to perform suction to clear secretions and maintain patency of the artificial airway. However, justification for undertaking the suction procedure can be based on a myriad of differing clinical opinions. Furthermore, there are significant clinical side effects associated with ETT suction that can seriously affect the clinical stability of the critically ill ventilated patient (Gilbert, 1999; Hazinski, 1999; Knox, 1992; Oh & Seo, 2003).

Clinical assessment usually guides a nurse's decision to determine a patient's need for ETT suction. As with all clinical practice, knowledge and experience can determine a nurse's ability to adequately perform such tasks (Epstein & Hundert, 2003; Manias & Bucknall, 2002; Mangione & Neiman, 1997; Runton, 1992; Swartz, Noonan & Edwards-Beckett, 1996). In the PIC setting the accurate assessment and application of invasive procedures can directly impact on the delivery of appropriate care for the patient within this area. The safe delivery of quality patient care should underpin all components of nursing care in the acute care setting. The inadvertent delivery of suboptimal care can lead to the occurrence of adverse events for the patient (Baun, 1984; Hazinski, 1999; Knox, 1992). Nursing staff working within critical care areas typically have varying degrees of experience which may play a role in the accurate clinical assessment of the patient's potential requirement for ETT suction. Previous strategies to guide practice and support both the inexperienced and experienced practitioner within the clinical setting have included assessment tools such as the VAS pain assessment tools (Appendix 1). These types of tools are quickly accessible, cheap to provide and easy to use. Despite the potential adverse effects for

the patient associated with ETT suction there is no published assessment tool specifically for the PIC setting available for nurses to guide their decision making about whether to perform the procedure.

When researching and designing any tool for use within the clinical setting it is essential the tool incorporates evidence from current practice and research. Evidence based practice evolving from the integration of current practice, knowledge and observed outcomes is accepted as improving clinical practice and patient care (Bliss-Holtz, 2007; Bucknall, Copnell, Shannon & McKinley, 2001; Kresse, Kuklinski & Cacchione, 2007; Sackett, Rosenberg, Gray, Haynes & Richardson, 1996). Decisions regarding evidence to be used in this process are usually based on observations of specific clinical indicators which can then be evaluated against normal parameters and outcomes. The most appropriate clinical indicators supporting clinical decisions should be incorporated and considered in tool design. The clinical indicators relevant to the ETT suction process were compiled and assessed as part of this study.

The basis of this study is to support and guide airway management by nurses, in this case the application of ETT suction within the PIC area, through the development of an evidence based assessment tool.

1.2 Study Aim

The aim of the study was to design an Endotracheal Suction Assessment Tool (ESAT) specifically for paediatric patients who are intubated and ventilated to assist all nurses working within this area.

To achieve this aim, a four phase study was planned. Phase One comprised a literature review to determine currently used criteria for performing endotracheal tube (ETT) suction. This was followed by the design of an Endotracheal Suction Questionnaire based on the findings from the literature review. In Phase Two, content and validity testing of the Endotracheal Suction Questionnaire was undertaken, resulting in refinement of the instrument. Phase Three involved the administration of the Endotracheal Suction Questionnaire to experienced paediatric intensive care (PIC) nurses within Australia and New Zealand in order to validate criteria identified in the literature review, and identify current practice. In Phase Four, an evidence based ESAT was developed based on findings from the previous phases.

1.3 Research Questions

The research questions for this study were:

1. Can a literature review identify either an evidence based respiratory assessment tool or common criteria used within the paediatric intensive care setting guiding nurses to perform endotracheal suction?
2. What common criteria identified within the literature are currently used within Australian and New Zealand PICs to assess the need for endotracheal suction in the intubated and ventilated PIC patient?
3. How do experienced Australian and New Zealand PIC nurses rate the importance of each criterion according to its significance and frequency of use when performing ETT suction?
4. Can the answers to the above questions lead to a workable evidence based ESAT to assist Australian and New Zealand PIC nurses regardless of their levels of experience?

1.4 Significance

Traditionally, nursing care of the endotracheal tube has been based on routine practice guidelines and clinical opinion rather than on evidence based procedural tools. There is limited nursing research on ETT suction that describes the criteria used by nurses to guide decision making about when to perform ETT suction. Moreover, no research has been conducted to develop a respiratory assessment tool that can be used by all levels of nurses working within paediatric intensive care to guide decision making about the performance of ETT suction. In keeping with the current trends in the clinical setting to establish evidenced based practice criteria, it is timely that an endotracheal suction assessment tool (ESAT) is developed to assist nursing staff of all levels of experience in determining the clinical indicators for ETT suction. An ESAT could potentially change the frequency of ETT suction a critically ill patient receives and provide clinical direction for the nurse caring for that patient. Such a tool would also establish a future context for research into the effectiveness of ETT suction outcomes as it will provide a more consistent framework for assessing suction techniques. While the performance of ETT suction is a routine procedure for

nurses working within paediatric intensive care units, the associated short and longer term respiratory and other physiological effects remain a problem for intubated and ventilated infants and children.

In the current healthcare climate, interventions which are both cost effective and result in improved and optimal patient outcomes are a global imperative. It is essential that paediatric intensive care nurses use evidence based respiratory assessment criteria when performing ETT suction in order to maximise short and longer term physiological outcomes for ventilated infants and children. This can be achieved by using a systematic approach in the assessment of respiratory and other physiological criteria in the determination of whether to perform ETT suction. The present study will achieve this by empirically determining the criteria that should be used in the process of ETT suction decision making, and the development of a systematic respiratory assessment tool to guide performance of ETT suction. The findings from this study will potentially have implications for both the inexperienced and experienced PIC nurse's clinical practice when caring for the intubated and ventilated child.

This initial chapter has provided the introduction, study aim, research questions and significance of this study. The relevant literature is discussed in Chapter 2, the conceptual framework supporting this study is described in Chapter 3, methods and procedures are presented in Chapter 4, and data analysis and findings in Chapter 5. The ESAT and discussion of the quantitative and qualitative results are presented in Chapter 6, followed by conclusions, recommendations and implications in Chapter 7.

CHAPTER 2

LITERATURE REVIEW

A review of the published literature relating to performance of endotracheal tube (ETT) suction in the intensive care setting was conducted. A search for evidence relating to this issue was conducted including an examination of the levels of evidence of the published research. Assessment criteria currently being used to determine the initiation of ETT suction were collated, along with the complications associated with ETT suction and recommendations for when ETT suction should be performed. The following interrelated issues were also explored briefly: standards of clinical assessment, knowledge and experience of nursing staff and retention of nursing staff. These issues are considered to directly impact on the performance and quality of ETT suction in the clinical setting and support the rationale behind the need for a standardised approach to clinical assessment for ETT suctioning. An in-depth analysis of the literature relating to the criteria used by nurses to facilitate decision making regarding when to initiate ETT suction in the PIC patient was then undertaken. As the study involved a qualitative research component content analysis of the literature was done to identify specific issues. These issues were later related back to the participant's responses to the qualitative questions in the Endotracheal Suction Questionnaire (Chapter 5).

A primary search of Cinahl, Medline and Pubmed databases using Ovid and a secondary search based on the references of the available literature identified 31 relevant articles published over the last 20 years. Articles related to paediatric, neonatal, adult and animal studies where specific criteria for commencement of the procedure were identified by the authors, as well as the clinical ramifications for the patient (Tables 2.1- 2.4). Articles describing neonatal and adult studies were included because of their contextual significance to the topic. The one animal study (Table 2.4) included in the review identified haemodynamic changes directly attributed to ETT suction. Tables 2.1 to 2.4 are divided into area of clinical research, clinical review and level of evidence. These tables appear in descending order of specificity to the paediatric setting (i.e. paediatric, neonatal, adult and animal studies).

Key search words used were “endotracheal tube”, “suction”, “suctioning”, “paediatric”, “pediatric”, “airway management”, “intubation”, “tracheobronchial”, “ventilated”, “patient”, “techniques”, “haemodynamic alterations”, “complications”,

“secretions”, “assessment tool” and “management”. Based on the Australian Government’s National Health and Medical Research Council “Levels of Evidence” (NHMRC, 2005) shown below in Table 2.5, no Level I evidence studies were identified. Two Level II evidence articles relating to neonatal or adult were identified. Eight articles were identified as being either Level III:1, III:2 or Level III:3; all related to adult or neonatal studies with the exception of one that related to paediatrics (Swartz, Noonan and Edward-Beckett; 1996). Twenty studies were rated as Level IV evidence and described neonatal, paediatric or adult research (Tables 2.1- 2.4).

Table 2.1

Paediatric Studies Related to Criteria used for the Initiation and Complications of Endotracheal Suction

<i>Author/s and dates of publication</i>	<i>Level of evidence & clinical area</i>	<i>Criteria identified for initiation of endotracheal suction</i>	<i>Identified clinical compromise in response to endotracheal suction</i>	<i>Recommendation for when endotracheal suction should be performed.</i>
1. Swartz, K., Noonan, D. & Edward-Beckett, J. (1996)	III.2 Paediatric	a. Nursing judgement. b. Patient's clinical condition.	1. Hypoxaemia. 2. Decreased blood pressure. 3. Decreased heart rate. 4. Increased intracranial pressure. 5. Alterations in cerebral blood flow.	Clinical assessment of patient.
2. Charland, S. (1999)	IV Neonatal & paediatric	a. Increased airway pressures. b. Altered haemodynamics. c. Decreased air entry. d. Change of colour. e. Tachycardia. f. Assessment of airway patency. g. Changes in minute volume. h. Altered chest movement. i. Increased airway pressures. j. Visible or audible secretions. k. Deterioration in arterial blood	1. Hypoxia. 2. Atelectasis. 3. Pneumothorax. 4. Infection. 5. Tissue damage. 6. Changes to heart rate. 7. Changes to blood pressure. 8. Changes in Intracranial pressure (ICP).	Clinical assessment of patient.

		gas results.		
3. Copnell, B. & Ferguson, D. (1995)	IV Paediatric	a. Colour. b. Respiratory effort. c. Decreased oxygen saturations. d. maintaining patency of ETT. e. Arterial blood gas results. f. Child's degree of distress. g. Haemodynamic changes. h. Ventilator parameters (no description given). i. Auscultation. j. Effectiveness of cough.	No comments on adverse effects.	Base on individual needs. Clinical guidelines require staff education.
4. Curley, M. A. Q. & Thompson, J. E. (1990)	IV Paediatric	a. Assessment of ventilation	No comment on adverse effects.	Clinical assessment of patient.

5. Gilbert, M. (1999)	IV Paediatric	<ul style="list-style-type: none"> a. Abnormal/diminished breath sounds. b. Dyspnoea, signs of distress and respiratory distress. c. Auscultation. d. Infant's activity. e. Tolerance for the procedure. f. Type and amount of secretions. g. Clinical condition. h. Vital signs. I. Heart rate. j. Alterations in arterial blood gas results. k. Decrease in oxygen saturations. m. Audible secretions. n. Cyanosis. o. Decreased tidal volume. p. Increased carbon dioxide. q. Coughing. 	<ul style="list-style-type: none"> 1. Hypoxaemia. 2. Cardiac dysrhythmias. 3. Fluctuations in cerebral blood flow. 4. Decreased lung compliance. 5. Negative intra-pulmonary pressures. 6. Atelectasis. 7. Laryngospasm. 8. Traumatic injury. 9. Infection. 	<ul style="list-style-type: none"> 1. Coughing. 2. Task/routine. 3. Changes in monitored vital signs. 4. Secretions. 5. Behaviour.
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		r. Feeling of secretions in chest. s. Altered chest movement. t. Visible secretions.		
6. Knox, A. M. (1992)	IV Paediatric	a. Respiratory distress. b. Auscultation and assessment. c. Breath sounds.	1. Dysrhythmias. 2. Laryngospasm. 3. Trauma. 4. Hypoxaemia. 5. Microatelectasis. 6. Pneumonia. 7. Hypotension. 8. Increased ICP. 9. Tube blockage. 10. Increased airway resistance. 11. Retrolental fibroplasia. 12. Sepsis.	Due to potential complications arising from ETT suction it should not be performed as part of routine care.

7. Page, N., Giehl, M. & Luke, S. (1998)	IV Paediatric	a. Clinical assessment b. Tube obstruction.	1. Atelectasis. 2. Barotrauma. 3. Pneumothorax.	Clinical assessment of patient.
8. Runton, N. (1992)	IV Paediatric	a. Accurate clinical assessment.	1. Mucosal damage.	Clinical assessment of patient.

Table 2.2

Neonatal Studies Related to Criteria used for the Initiation and Complications of Endotracheal Suction

<i>Author/s and dates of publication</i>	<i>Level of evidence & clinical area</i>	<i>Criteria identified for initiation of endotracheal suction</i>	<i>Identified clinical compromise in response to endotracheal suction</i>	<i>Recommendation for when endotracheal suction should be performed.</i>
1. Pritchard, M. A., Flenady, V. & Woodgate, P. (2003)	II Neonatal	a. Secretion removal. b. Protocol.	1. Hypoxaemia. 2. Alterations in blood pressure. 3. Bradycardia. 4. Tachycardia. 5. Atelectasis. 6. Localised airway trauma. 7. Sepsis. 8. Tube displacement.	Further research required.
2. Durand, M., Sangha, B., Cabal, L. A., Hoppenbrouwers, T. & Hodgman, J.E. (1989)	III.1 Neonatal	a. TCPaO ₂ and TCPaO ₂ changes. b. Arterial blood pressure changes. c. Intracranial (ICP) and cerebral pressure perfusion (CPP) changes.	1. Increased ICP readings. 2. Changes in arterial blood pressure. 3. Changes in heart rate.	Careful consideration due the potential changes in ICP.

3. Tolles, C. & Stone, K. S. (1990)	III.2 Neonatal	a. Maintain the airway. b. Ineffective cough. c. Facilitate oxygenation and ventilation.	1. Hypoxaemia. 2. Arterial oxygen changes. 3. Bradycardia's. 4. Cardiac dysrhythmias. 5. Increased intracranial pressure. 6. Pneumothorax. 7. Atelectasis. 8. Death.	Written procedures and clinical experience.
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4. Hodge, D. (1991)	IV Neonatal & Paediatric (Neonatal Focus)	a. Auscultation of the chest. b. Acute physiological changes – no statement on what changes. c. TcPaO ₂ and TcPaO ₂ changes.	1. Atelectasis. 2. Hypoxia. 3. Cerebral blood flow alterations. 4. Trauma. 5. Pneumothorax. 6. Perforation. 7. Mucosal damage. 8. Necrotising tracheobronchitis. 9. Dysrhythmia. 10. Altered pulmonary compliance.	Suctioning should be based on the individual patient's clinical condition and symptoms.
5. Dougherty-Wrightson, D. & Askin, D. F. (1999)	IV Neonatal	a. Decreased SaO ₂ . b. Routine. c. Altered haemodynamics. d. Decreased air entry. e. Previous secretion removal.	1. Hypoxia. 2. Atelectasis. 3. Pneumothorax. 4. Infection. 5. Tissue damage. 6. Changes to heart rate. 7. Changes to blood pressure. 8. Changes in ICP.	Suction only when the infant requires it.

6. Kondo, Y. & Horiuchi, S. (1999)	IV Neonatal	No comment provided.	1. Stressing of patient during procedure. 2. Heart rate changes (not stated what changes). 3. Oxygen saturation changes.	Careful consideration if procedure required due the patient stress involved.
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Table 2.3

Adult Studies Related to Criteria used for the Initiation and Complications of Endotracheal Suction

<i>Author/s and dates of publication</i>	<i>Level of evidence & clinical area</i>	<i>Criteria identified for initiation of endotracheal suction</i>	<i>Identified clinical compromise in response to endotracheal suction</i>	<i>Recommendation for when endotracheal suction should be performed.</i>
1. Dyhr, T., Bonde, J. & Larsson, A. (2003)	II Adult	a. Secretion removal.	1. Negative effects on airway.	Avoid if possible due to negative effects.
2. Day, T., Wainwright, S. P. & Wilson-Barnett, J. (2001)	III.1 Adult	a. Chest auscultation. b. Adequate ventilation. c. Adequate oxygenation.	1. Trauma. 2. Bronchospasm. 3. Hypoxaemia. 4. Cardiac arrest. 5. Sudden death.	Clinical guidelines needed to support clinical practice.
3. Day, T., Farnell, S., Haynes, S., Wainwright, S. & Wilson, J. (2002)	III.1 Adult	a. Chest auscultation.	No comment provided.	Clinical assessment of patient.
4. Baun, M. M. (1984)	III.3 Adult	a. Decreased lung compliance. b. Secretions. c. Measuring functional residual capacity. d. Pa O ₂ .	No comments on adverse effects.	Not discussed.

5. Carhuapoma, J. R. & Williams, M. A. (1999)	III.3 Adult	a. Secretion removal.	1. Increased ICP.	Careful consideration for the requirement of ETT suctioning.
6. Walsh, J., Vanderwarf, C., Hoscheit, D. & Fahey, P. (1989)	III.3 Adult.	a. Secretion removal. b. Routine. c. Clinically indicated.	1. Damage to bronchial epithelium. 2. Haemodynamic complications. 3. Hypoxaemia. 4. Cardiac arrhythmias. 5. Hypotension. 6. Sudden death.	Clinical assessment of patient.
7. Ahrens, T. & Sona, C. (2003)	IV Adult	a. Assessment of ventilation and graphical wave patterns.	No comment on adverse effects.	No comment provided.
8. Blackwood, B. (1999)	IV Adult	a. Assessment of minute volume. b. Assessment of tidal volume.	No comment provided.	Clinical assessment of patient.
9. Carroll, P. (2003)	IV Adult	No comment provided.	No comment on adverse effects.	
10. Chang, V. M. (1995)	IV Adult	a. Assess the patient's breath sounds to determine the need for suction.	1. Hypoxaemia. 2. Cardiac dysrhythmia. 3. Oxygen desaturation. 4. Micro-atelectasis. 5. Decrease cardiac output.	Patient assessment.

11. Cook, D., Richard, J. D., Reeve, B., Randall, J., Wigg, M., Brochard, L. & Dryfuss, D. (2000)	IV Adult	No comment provided.	No comment provided.	No comment provided.
12. Moore, T. (2003)	IV Adult	a. Increased airway pressures. b. Altered haemodynamics. c. Decreased air entry. d. Change of colour. e. Tachycardia. f. Assessment of airway patency. g. Changes in minute volume. h. Altered chest movement. i. Increased airway pressures. j. Visible or audible secretions. k. Deterioration in arterial blood gas results. l. Feeling of secretions in chest. m. Tachypnoea.	1. Mucosal damage. 2. Dyspnoea. 3. Atelectasis. 4. Hypoxaemia.	Clinical assessment of patient.

13. Oh, H. & Sea, W. (2003)	IV.	a. Secretion removal.	1. Hypoxia. 2. Atelectasis. 3. Laryngospasm. 4. Trauma. 5. Dysrhythmias.	No comment provided.
14. Place, B. and Fell, H. (1998)	IV Adult	a. Audible secretions on auscultation. b. Coughing. d. Decreased air entry on auscultation. e. Restlessness.	1. Increased intrathoracic pressure. 2. Vagal stimulation causing hypotension. 3. Decrease in arterial oxygenation caused by the suctioning of alveolar gases. 4. Changes in oxygen consumption inducing haemodynamic changes.	Determining the balance between the risk of suctioning and the accumulation of secretions
15. Wainwright, S. & Gould, D. (1996)	IV Adult	a. Facilitate ventilation. b. Maintain adequate oxygenation.	1. Tracheal trauma. 2. Bronchoconstriction. 3. Increased intracranial pressure. 4. Hypoxaemia. 5. Hypotension. 6. Cardiac dysrhythmias. 7. Cardiac arrest.	Further research required.
16. Wood, C. J. (1998)	IV	a. Auscultation.	No comments on adverse effects.	Not discussed.

	Adult	b. Decreased air entry. c. Increased peak inspiratory pressures. d. Audible or visible secretions. e. Increased work of breathing. f. Query aspiration of secretions. g. Coughing.		
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Table 2.4

Animal Study Related to Criteria used for the Initiation and Complications of Endotracheal Suction

<i>Author/s and dates of publication</i>	<i>Clinical area</i>	<i>Criteria identified for initiation of endotracheal suction</i>	<i>Identified clinical compromise in response to endotracheal suction</i>	<i>Recommendation for when endotracheal suction should be performed.</i>
1. Lim, S. C., Adams, A. B., Simonson, D. A., Dries, D. J., Broccard, A. F., Hotchkiss, J. R. & Marini, J. J. (2004)	Animal	No comment provided.	1. Haemodynamic compromise.	No comment provided.

Table 2.5

Levels of Evidence

Level of Evidence	Definition
Level I	A systematic review of all relevant randomised controlled trials.
Level II	One or more randomised controlled trial
Level III.1	Controlled trials without randomisation.
Level III.2	Cohort or case control studies from more than one centre.
Level III.3	Multiple time series with or without intervention
Level IV	Opinion of clinical experts, results from descriptive studies or reports.

(National Health and Medical Research Council, 2005, p. 4)

2.1 Definition of Terms

For the purpose of this study, the following definitions were used throughout the literature review and subsequent chapters.

Assessment tool: A tool to assist in the appraisal or evaluation of a patient's clinical condition.

Complication: A negative result or reaction associated with the underlying disease or process.

Experienced Paediatric Intensive Care (PIC) nurse: A nurse working within a Paediatric Intensive Care Unit for five or more years or a nurse who has a postgraduate qualification in Paediatric Intensive Care.

Secretions: A substance such as saliva and mucous secreted within the airway.

Suction (ing): The process of aspirating fluid and/or other material from an area.

Technique: The systematic procedure by which a complex or scientific task is accomplished.

(MedicineNet.com, 2007; Dinkx, 2001)

2.2 Criteria for Endotracheal Suctioning

As shown in Tables 2.1-2.4, 31 articles were identified that specifically used clinical indicators to suggest when endotracheal tube (ETT) suction should be performed and the potential clinical complications associated with the procedure. Although the general consensus in the current literature was that ETT suction be performed according to the clinical condition and symptoms of the patient (Tables 2.1- 2.3), there was wide discrepancy in the criteria used to determine when the procedure should be performed. Table 2.6 has been included here to show the 49 criterion identified within the literature to justify the initiation of ETT suction.

Of the 31 articles reviewed only eight related specifically to the target population and the process under research (Table 2.1). Of the eight paediatric specific articles only that of Swartz and colleagues (1996) was regarded as Level III.2 evidence; the others were rated as Level IV evidence. The population described by Swartz and colleagues (1996) comprised nurses with more than three years paediatric intensive care (PIC) nursing experience and involved a cohort study. The six remaining paediatric based articles comprised three literature reviews, two descriptive studies and one describing clinical opinion. Though the other 23 articles were not paediatric specific the assessment processes and criteria identified could potentially be relevant to the paediatric setting and formed part of the literature reviewed.

On further examination of the articles detailed in Tables 2.1-2.4, Kondo and Horiuchi (1999) and Lim and colleagues (2004) identified no specific criteria for the initiation of endotracheal suction but did identify haemodynamic compromise as a complication of the procedure. Haemodynamic compromise can occur from changes in tissue oxygenation directly affecting cardiac tissue perfusion and function (Chang, 1995; Charland, 1999; Copnell & Ferguson, 1995; Page, Giehl & Luke, 1998).

Durand, Sangha, Cabal, Hoppenbrouwers and Hodgman (1989) and Hodge (1991) included changes in TcPaCO₂ and TcPaO₂ as criteria that were directly linked to tissue oxygenation and cardiac function. Both papers described physiological changes that contributed to initiation of the ETT suction procedure, as did Dougherty-Wrightson and Askin (1999), Hodge (1991) and Gilbert (1999). However, Hodge (1991) did not state the nature of these physiological changes. Dougherty-Wrightson

and Askin (1999) identified changes in oxygen saturations, decreased air entry, previous secretional removal and altered haemodynamics as part of these changes. Durand and colleagues (1989) identified these physiological changes as changes in arterial blood pressure, intracranial and cerebral pressure perfusion. These parameters were inter-linked to the patient suffering from head trauma. Optimising oxygen delivery to the brain and minimising ischaemic brain damage can affect neurological outcomes (Hazinski, 1999; White & Dalton, 2002).

Gilbert (1999) discussed changes in vital signs and signs of respiratory distress. These physiological changes may be exacerbated by the suction procedure itself if pre and post hyper-oxygenation is part of the procedure (Dyhr, Bonde & Larsson, 2003). Physiological changes can occur during the suction procedure as excessive positive end expiratory pressure (PEEP) during hand ventilation can cause volutrauma to the airways or compromise cardiac pre-load (Pruitt & Jacobs, 2006; White & Dalton, 2002).

Criteria specifically relating to airway assessment and ventilation were cited in 18 articles as precursors to endotracheal suction being preformed. These articles varied in their description of respiratory assessment. Fifteen of the articles reviewed identified auscultation of the chest or changes in ventilation airway specific clinical assessment parameters (Ahrens & Sona, 2003; Baun, 1984; Blackwood, 1999; Chang, 1995; Curley & Thompson, 1995; Hodge, 1991; Day, Wainwright & Wilson-Barnett, 2001; Day, Farnell, Haynes, Wainwright & Wilson, 2002; Gilbert, 1999; Moore, 2003; Place & Fell, 1998; Tolles & Stone, 1990; Dougherty-Wrightson and Askin, 1999; Wainwright & Gould, 1996; Wood, 1998).

Knox (1992), Place and Fell (1998), Dougherty-Wrightson and Askin (1999) and Gilbert (1999) expanded on the process of respiratory assessment to include signs of respiratory distress and diminished breath sounds. Place and Fell (1998), Carhuapoma and Williams (1999), Dougherty-Wrightson and Askin (1999), Gilbert (1999) and Dyhr, Bonde and Larsson (2003) included secretion removal as a criterion for endotracheal suction. Of these articles Place and Fell (1998) and Gilbert (1999) provided the most detailed information regarding clinical assessments that would indicate the use of endotracheal suction as a warranted intervention.

Three articles cited secretion removal only as the precursor for ETT suction without relating it to respiratory assessment (Pritchard, Flenady & Woodgate, 2003; Walsh, Vanderwarf, Hoscheit & Fahey, 1989; Oh & Sea, 2003).

Two articles did not comment on why the procedure was initiated (Carroll, 2003; Cook, Richard, Reeve, Randall, Wigg, Brochard & Dryfuss, 2000).

One article by Runton (1991) identified “accurate clinical assessment” as the criteria for ETT suction but did not expand on this statement.

Two other articles by Baun (1994) and Day, Wainwright and Wilson-Barnett (2001) used data gathered from nurses working within an adult intensive care setting. These studies cited nurses had varying levels of experience but did not specify the actual level of experience of those. These findings are open to interpretation as nurses may have had varying levels of experience ranging from novice nurses with three to 12 month’s experience to senior nurses with up to 20 years experience. The validity of observations could be indirectly affected by these variations in variables.

A total of 49 criteria were identified as the motivation for performing endotracheal suction (Table 2.6). No single article identified each of these criteria. There may be several reasons for this including:

- Varying experience of the nursing staff involved
- Differing clientele and management within each intensive care unit
- Differing technology used for patient care within each intensive care unit
- Poor clarification of the terminology used
- Limitations of the research tool used to obtain data
- Design flaws in the research tool used to obtain data
- Restricted range of patient diagnoses

Based on the reviewed literature the identified criteria were then allocated to one of four broad categories; “respiratory”, “ventilation”, “haemodynamic” and “physical descriptors”.

Table 2.6

Criteria Identified for Initiation of Endotracheal Suction

RESPIRATORY
Signs of respiratory distress eg: dyspnoea, nasal flaring, tracheal tug.
Decreased air entry on auscultation and assessment
Altered breath sounds
Audible secretions on auscultation
Visible secretions
Coughing
Decreased SaO ₂
Previous secretion removal
Increased carbon dioxide
Altered chest movement
Type and amount of secretions
Cyanosis
TcPaO ₂ and TcPaCO ₂ changes
Feeling of secretions in chest on palpation
Secretion removal
To obtain a sputum specimen
To stimulate a cough
To determine effectiveness of patient cough
Suspected aspiration of gastric secretions
Respiratory noise
Increased respiratory rate
VENTILATION
Decreased tidal volume
Increased peak inspiratory pressures associated with volume controlled ventilation
Ventilator parameters – not stated what
Assessment of compliance
Assessment of minute volume
Assessment of tidal volume
High pressure alarm on ventilator
Pre-set tidal volume not being delivered
Maintaining patency of ETT

Table 2.6 continued

Criteria Identified for Initiation of Endotracheal Suction

HAEMODYNAMIC
Increased heart rate
Arterial blood pressure changes
Acute physiological changes
Intracranial (ICP) and cerebral pressure perfusion (CPP) changes
Altered haemodynamics
PHYSICAL DESCRIPTORS
Colour
Accurate assessment
Clinical condition
Restlessness
Increased work of breathing
Respiratory effort/pattern
Child's degree of comfort/distress
Patient attempting to spontaneously cough
Tolerance for the procedure
Appearance of infant
Age
Diagnosis
Routine
Other – not stated

It is likely the complexity of this issue and the wide range of diagnoses of critically ill intensive cares patients affect selection of suitable ETT suction criteria for individual cases. It seems appropriate that a basic set of parameters or criteria be identified to provide the inexperienced practitioner with, at the very least, a point of reference for assessment of the respiratory status of the ventilated patient. It is proposed that standards of care cannot be appropriately identified and implemented if the principles of such care are not clearly defined.

The literature review provided a means to identify current knowledge, standards of care and methodologies associated with the research topic, but were limited by the level of evidence available and relevance to the research questions (Burns, 2000; Polit & Hungler, 1993; Rowntree, 1991). Since the criteria used for initiating endotracheal suction were not clearly identified or explained in the articles reviewed, it was considered appropriate this be addressed as part of the current research study. The majority of the criteria identified are important but could be classified under respiratory, ventilation, haemodynamic and physical descriptor

categories. Following review of these criteria, based on practicality for questionnaire design, those criteria that were essentially measuring the same characteristics but using different terminologies were combined. As a result, 15 criteria were defined for use within the Endotracheal Suction Questionnaire (ESQ) (Appendix 17). The validity of these criteria for inclusion or exclusion in the ESQ formed part of the Phase Two testing. To add further rigour to the appropriateness of the criteria included or excluded in the ESQ, inclusion of a qualitative component in the ESQ enabled participants to describe a recent endotracheal tube (ETT) suction event and to identify other criteria (not previously listed in the ESQ) that formed part of their clinical assessment process in regards to the requirement for ETT suction.

As clinical assessment can impact on the quality of care delivered to the patient, specifically the interpretation of criteria used to assess the requirement for endotracheal suction, the following section briefly reviews the current standard of clinical assessment and the influence the level of nursing knowledge and skills has on patient care within the critical care setting.

2.3 Standard of Clinical Assessment

As a specialty area, the PICU is faced with complex care issues related both to the clinical condition of the patient as well as the technology required to facilitate and deliver patient care. The accurate assessment of ventilation and oxygenation of the ventilated critically ill patient is fundamental to the care of the patient in the intensive care setting (Curley & Moloney-Harmon, 2001; Hazinski, 1999). Review of medical and nursing literature about competency in respiratory assessment skills identified a number of inadequacies (Day, Farnell, Haynes, Wainwright & Wilson-Barnett, 2002; Epstein & Hundert, 2002). These included: poor proficiency of assessment skills; errors in physical diagnosis and poor quality of nursing judgement in making a respiratory assessment. Compounding these issues was inadequate knowledge of protocols and practices that directly impact on the quality of patient care (Blackwood, 1999; Day, Farnell, Haynes, Wainwright & Wilson-Barnett, 2002; Day, Wainwright & Wilson-Barnett, 2001; Cousins & Power, 1999; Jacobe, Denessen & Postma, 2004; Lester & Tritter, 2001; Mangione & Neiman, 1997; McGlynn & Brook, 2003; Moore, 2003). To address these issues, strategies such as continuing education, evidence

based practice, use of assessment tools and maintenance of clinical support in the PIC arena have been shown to improve both patient care and outcome (McGlynn & Brook, 2003; Moore, 2003). These issues together with the potential complications associated with endotracheal suction add further support to the development of an evidence based Endotracheal Suction Assessment Tool.

2.4 Influence of Level of Nursing Knowledge and Skills on Patient Care

Advances in patient care delivery and the increased reliance on technology within the health care setting, particularly in intensive care units, has changed the knowledge base, skills and standards of nursing care required to effectively care for the critically ill patient (Baggot et al, 2005; CDEST, 2001). Increasingly, critically ill paediatric patients may have complex problems that are often associated with changes in the child's clinical condition (e.g. deterioration from an initial diagnosis of respiratory distress to multi-organ failure, which leads to a number of co-morbidities) (Baggot et al., 2005; Ryan, Hills & Webb, 2004; CDEST, 2001). Given these challenges, supporting clinical practice through the use of innovative and creative methods can potentially assist health professional's job performance and staff retention (Abu-Saad, Bours, Stevens & Hamers, 1998; Cousins & Power, 1999).

As with any area of clinical practice, nurses working within the PIC area require support and guidance to maintain safe nursing practice and quality patient care. These nurses can have a varied level of experience, knowledge and skill. Implementation of policies, guidelines and assessment tools to support staff in delivering quality patient care have been shown to improve job satisfaction and retention of nursing staff, particularly those with significant inexperience working in specialised areas (Baggot et al 2005; Ryan et al, 2004; Strachota, Normandin, O'Brien, Clary & Krukow, 2003; Wicker, 1997). In compiling and assessing the aggregate experience of a large population of experienced nurses, the development of an assessment tool for endotracheal tube suction would potentially benefit all nurses. Importantly, nurses can benefit from evidence based assessment tools they can use at the bedside to facilitate the delivery of quality care in a timely fashion. An example of an innovative and cost-effective tool that is widely used in patient care is the Visual Analogue Scale (VAS) for pain assessment (Appendix 1). The simplicity of the VAS

pain assessment tool both in design and ease of use guided the researcher to use this same approach as the conceptual basis for the development of an Endotracheal Suction Assessment Tool for this study (Abu-Saad, Bours, Stevens & Hamers, 1998; Cousins & Power, 1999).

The following section discusses the complications associated with endotracheal suctioning as identified within the reviewed literature.

2.5 Complications of Endotracheal Suction

In 2005 for Australian and New Zealand paediatric intensive care units, 23% of all admissions were directly related to a diagnosis of respiratory failure (Torton, Norton & Slater, 2005). Endotracheal tube (ETT) suction therefore represents a procedure that is commonly performed within the paediatric intensive care area. The intubated patient is dependent upon the nurse caring for him/her to ensure and maintain the patency of the ETT to enable oxygenation and carbon dioxide removal. While adequate sedation and pain relief can minimise some of the complications associated with ETT intubation such as anxiety and tachycardia, adverse responses to ETT suction in the unstable patient remains a further potential complication (Charland & Rouleau, 1999; Dougherty, Wrightson & Askin, 1999; Gilbert, 1999; Sahinler, 2002).

Adverse effects of ETT suction are well documented for the critically ill patient (Table 2.7). The commonality of these adverse effects due to ETT suction is dependent on the clinical stability and underlying pathophysiology of the disease process for the individual patient. Common problems associated with the ETT suction procedure may be directly linked to the diagnostic group. For example, the patient with respiratory failure as a diagnosis may adversely react to ETT suction clinically with alterations in oxygen saturations more often than the patient with gastrointestinal dysfunction (Curley & Moloney-Harmon 2001; Hazinski, 1999).

The most significant complications relating to the respiratory stability of the patient include changes in lung volume, lung compliance, oxygen and carbon dioxide gas exchange. These alterations in lung dynamics can potentiate hypoxaemia which can adversely affect the cardiac output of the patient, altering both blood flow and oxygen delivery at a cellular level; hence ETT suction can adversely affect the clinical

stability of the patient (Curly & Harmon, 2001; Dyhr, Bonde & Larsson, 2003; Hazinski, 1999). The more serious but less common complications associated with ETT suction include cardiac arrest and sudden death. A comprehensive list of potential complications categorised as either respiratory and haemodynamic effects is presented in Table 2.7 (Carhuapoma & Williams, 1999; Day et al, 2001; Dougherty, Wrightson & Askin, 1999; Durand, Sangha, Cabal, Hoppenbrouwers & Hodgeman, 1989; Dyhr, Bonde & Larsson, 2003; Gilbert, 1999; Hodge, 1991; Knox, 1992; Kondo & Horiuchi, 1999; Lim et al, 2004; Oh & Sea, 2003; Place & Fell, 1998; Salvatore et al, 2003; Walsh et al, 1989; Young-Ra, Hee-Seung & Jeong-Hwan, 2002). These adverse effects are potentially serious complications that can affect the outcome of the patient's recovery from his/her illness. Potential complications warrant serious consideration about why the ETT suction procedure is initiated and have guided the focus for this study.

There is a consensus of opinion among researchers that a patient's clinical stability requires careful assessment and that in conjunction with the underlying diagnosis, may affect the frequency and need for ETT suction (Carhuapoma & Williams, 1999; Day et al, 2001; Dougherty, Wrightson & Askin, 1999; Durand, Sangha, Cabal, Hoppenbrouwers & Hodgeman, 1989; Dyhr, Bonde & Larsson, 2003; Gilbert, 1999; Hodge, 1991; Knox, 1992). It is critical that nurses understand these issues and the use of an Endotracheal Suction Assessment Tool (ESAT) could potentially provide guidance for nursing practice.

The following section uses content analysis to identify the codes within the reviewed literature that directly relate to why endotracheal suction is initiated.

Table 2.7

Adverse Effects of Endotracheal Suctioning

RESPIRATORY EFFECTS
Hypoxaemia
Oxygen saturation changes
Tissue damage
Trauma
Microatelectasis
Mucosal damage
Increased airway resistance
Contamination of airway, infection and sepsis
Paroxysmal coughing due to the procedure
Negative intra-pulmonary pressures
Decrease in arterial oxygenation caused by the suctioning of alveolar gases
Altered pulmonary compliance
Perforation
Bronchospasm and bronchial constriction
Bleeding
Tube blockage
Pneumothorax
Laryngospasm
Necrotising tracheobronchitis
HAEMODYNAMIC EFFECTS
Anxiety
Stressing of patient during procedure
Increased intrathoracic pressure
Haemodynamic compromise
Heart rate changes
Vagal stimulation causing hypotension
Hypotension
Hypertension
Dysrhythmias
Changes in oxygen consumption inducing haemodynamic changes
Cyanosis
Pallor
Cerebral blood flow alterations
Cardiac arrest
Sudden death

2.6 Analysis of the Literature

When reviewing the literature on endotracheal suction the following issues were considered important when determining why endotracheal suction was performed:

1. Physical signs
2. Patient direction
3. Routine nursing action
4. Pathophysiology and clinical stability
5. Clinical diagnostic techniques

These issues can be analysed for their content and further broken down into specific clinical criteria (Liamputtong & Ezzy, 2005; Speziale & Carpenter, 2007).

Initially there was broad reference to “clinical indicators” relating to the patient’s respiratory status that would require initiating suction of the endotracheal tube (Baun, 1984; Chang, 1995; Copnell & Fergusson, 1995; Dougherty-Wrightson & Askin, 1999; Gilbert, 1999; Hodge, 1991; Knox, 1992; Moore, 2003; Place & Fell, 1998; Runton, 1992; Swartz, Noonan & Edward-Beckett, 1996; Wood, 1998). Further in-depth analysis showed these “clinical indicators” included “visible or audible secretions” in the endotracheal tube which contributed to the respiratory assessment process and are attributed to the “physical signs” identified in the initial review of the literature (Dougherty-Wrightson & Askin, 1999; Baun, 1984; Carhuapoma & Williams, 1999; Copnell & Fergusson, 1995; Day, Wainwright & Wilson-Barnett, 2001; Dyhr, Bonde & Larsson, 2003; Gilbert, 1999; Moore, 2003; Place & Fell, 1998; Runton, 1992; Swartz, Noonan & Edward-Beckett, 1996; Wood, 1998).

Some authors referred to “patient assessment”, however, the focus was in fact involving respiratory assessment by observing for changes in oxygen saturations not attributed to any other clinical cause or auscultation of the lung fields where changes in “air entry and audible secretions” would indicate the need for endotracheal suction to occur (Baun, 1984; Chang, 1995; Copnell & Fergusson, 1995; Day, Wainwright & Wilson-Barnett, 2001; Dougherty-Wrightson & Askin, 1999; Gilbert, 1999; Hodge, 1991; Knox, 1992; Moore, 2003; Place & Fell, 1998; Runton, 1992; Swartz, Noonan & Edward-Beckett, 1996; Wood, 1998).

“Patient direction” involved either the patient indicating the need for endotracheal suction by either spontaneous coughing or non-verbal cues such as increased patient restless or facial grimacing that was not related to other factors than secretions within the endotracheal tube (Gilbert, 1999; Hodge, 1991; Moore, 2003; Place & Fell, 1998; Tolles & Stone, 1990).

“Haemodynamic changes” were viewed as acute physiological changes not attributed to any other cause bar the presence of secretions obstructing the endotracheal tube or lower lung fields and can be viewed as a more specific criteria under “pathophysiology and clinical stability”(Ahrens & Sona, 2003; Dougherty-Wrightson & Askin, 1999; Copnell & Fergusson, 1995; Hodge, 1991; Moore, 2003; Swartz, Noonan & Edward-Beckett, 1996; Walsh, Vanderwarf, Hoscheit & Fahey, 1989; Wood, 1998).

“Routine nursing action” could involve maintaining patency of the endotracheal tube by routine suction as designated by a specified time frame; for example, every four hours, suction attributed to suspected aspiration or to stimulation of a cough for specimen collection (Dougherty-Wrightson & Askin, 1999; Copnell & Fergusson, 1995; Gilbert, 1999; Runton, 1992; Wainright & Gould, 1996; Wood, 1998).

“Patient’s diagnosis” had a direct impact on the rationale for performing endotracheal suction as did “a patient’s previous tolerance to the procedure” (Ahrens & Sona, 2003; Swartz, Noonan & Edward-Beckett, 1996).

“Clinical diagnostic techniques” involved either non invasive monitoring such as observing for changes in carbon dioxide concentrations through end tidal readings or transdermal readings, or monitoring changes in the artificial ventilation of the patient such as decreased tidal volumes or high pressure alarms (Blackwood, 1999; Copnell & Fergusson, 1995; Curley & Thompson, 1990; Durand, Sangha, Cabal, Hoppenbrouwers & Hodgman, 1989; Gilbert, 1999; Hodge, 1991; Moore, 2003; Runton, 1992; Schallom & Ahrens, 2001; Swartz, Noonan & Edward-Beckett, 1996; Tolles & Stone, 1990; Wood, 1998).

Invasive monitoring involved assessing changes in “arterial blood gas results” that could indicate the requirement for endotracheal suction (Copnell & Fergusson, 1995; Durand, Sangha, Cabal, Hoppenbrouwers & Hodgman, 1989; Swartz, Noonan & Edward-Beckett, 1996).

These issues will be directly related to the design of the ESQ and the ESAT, which will be further discussed in Chapters 5 and 6.

In summary, the complications associated with endotracheal suction can have a dramatic effect on the stability of the clinical condition of the patient. These complications are either related to airway effects or haemodynamic effects including hypoxaemia and dysrhythmias. The issue surrounding the criteria used to initiate endotracheal suction is complex. There were a varied number of criteria identified in the reviewed literature that were not always clearly defined. These criteria included changes in clinical observations relating to the patient's vital signs to audible or visible secretions. The clinical criteria identified within the literature formed the basis of the criteria used in the design of the ESQ. Clinical assessment should be thorough, proficient and based on sound knowledge to identify key clinical indicators for endotracheal suction because of the potential risk to the patient. Added to this, decision making by nurses may vary due to differences in clinical assessment skills, knowledge and experience of the nurse involved. No researcher has fully addressed the issues associated with performance of this procedure, particularly within the paediatric setting. The research design for this study was carefully chosen to allow consideration of issues raised in this review of the literature.

CHAPTER 3

THEORETICAL FRAMEWORK

The theoretical framework for this study was based upon concepts described in the Nursing Process Theory (Marriner-Tomey & Raile-Alligood, 2002; Varcoe, 1996). The nursing process was initially developed by Ida Jean Orlando in 1961 who presented interrelated concepts that defined the nursing phenomena in a systematic format (Marriner-Tomey & Raile-Alligood, 2002). Orlando portrayed basic nursing practice as a series of integrated processes that involve observation, reporting, recording and action supporting the notion that dynamic interaction between the client and nurse is an evolving process under constant reassessment and change (Fedorka & Husted, 2004; Pinnell & De Meneses, 1986; Varcoe, 1996). Orlando's process can be illustrated graphically as shown in Figure 1.

There are relationships between these concepts that have a direct impact on the nursing process. These explain what occurs and why, during the process described. As nursing phenomena can be controlled, outcome predictions can be made (Marriner-Tomey & Raile-Alligood, 2002). In practical terms, the nursing actions being researched in the context of the "nursing process" in the clinical setting are as follows. First the nurse observes changes in the individual patient's clinical signs or behaviour; for example, a decrease in the patient's oxygen saturations to 85%. The nurse reacts to this change by assessing the patient clinically; for example, chest auscultation revealing audible secretions in the lower bronchi. Based on the results of the patient assessment the nurse may decide the appropriate nursing action would be to perform endotracheal tube (ETT) suction. The ETT suction procedure is performed and the nurse then reassess the patient to determine whether the procedure has improved oxygenation; for example, an increase in the patient's oxygen saturations to 95%. For the purpose of this study which explores why a nurse instigates the ETT procedure, a link is established between the observed and recorded actions and the specific action taken as a result of these observations which can be identified and contextualised to promote an appropriate outcome.

As cited in Marriner-Tomey & Raile-Alligood (2002, p.409), "the function of professional nursing is conceptualised as finding out and meeting the patient's immediate need for help." The nurse is continually responding to the patient's

inability to meet his/her own needs through assessing his/her behaviour. Therefore, the nurse reacts to these unfulfilled needs, instigates care as indicated to meet these needs and then reassesses the outcome. This study was based on this premise that accurate identification through selective criteria of the patient's need for ETT suction will alleviate unnecessary invasive procedures and minimise complications associated with direct patient care.

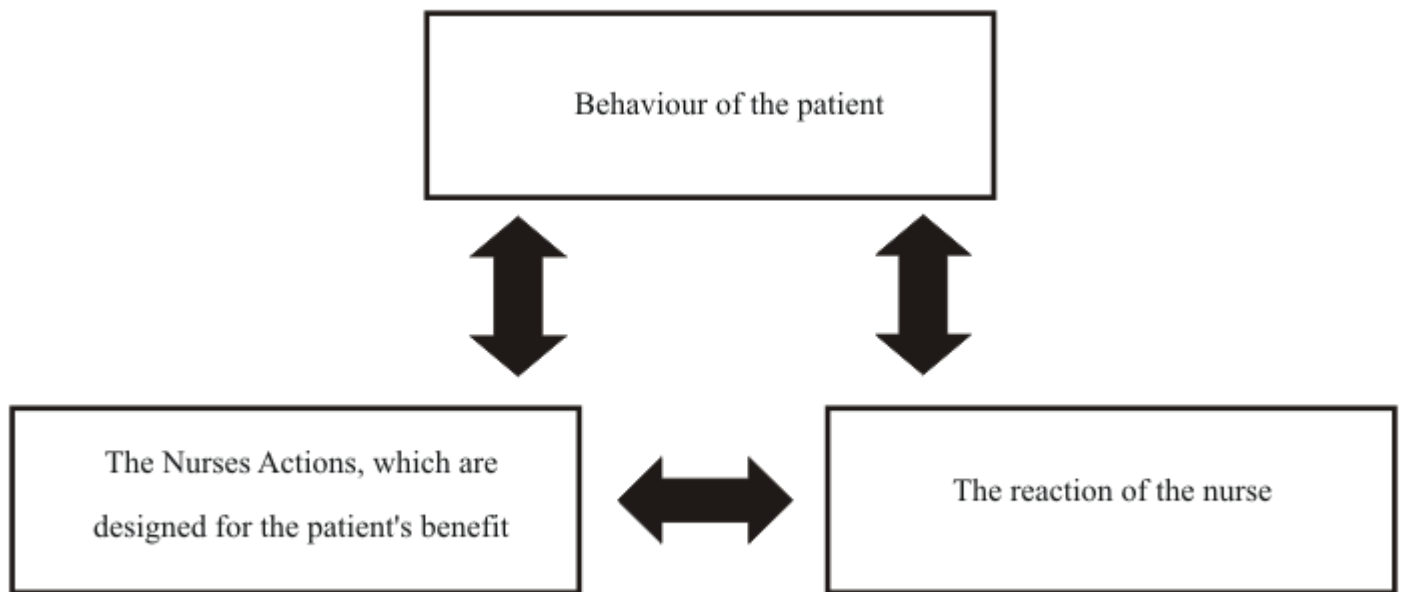


Figure 1. Orlando's nursing process (adapted from Marriner-Tomey & Raile-Alligood, 2002).

The conceptual model for this study integrates the nursing process into paediatric intensive care (PIC) setting and is shown in Figure 2. The initial construct is represented in the top positioned box and demonstrates the nurse allocated to care for a patient will assess his/her respiratory status. Next, the patient's clinical response to endotracheal tube secretions is assessed by the nurse who decides on a course of action, as illustrated in the right hand lower box. The association between these variables is illustrated by the two-way arrow. The left hand box represents the initiation of the treatment required. The two-way arrows between all the boxes contain the individual constructs within a circular process. The continuous assessment and reassessment of the patient within the PIC unit is a key nursing process, used to assess both the effectiveness of the treatment initiated and the clinical status of the patient.

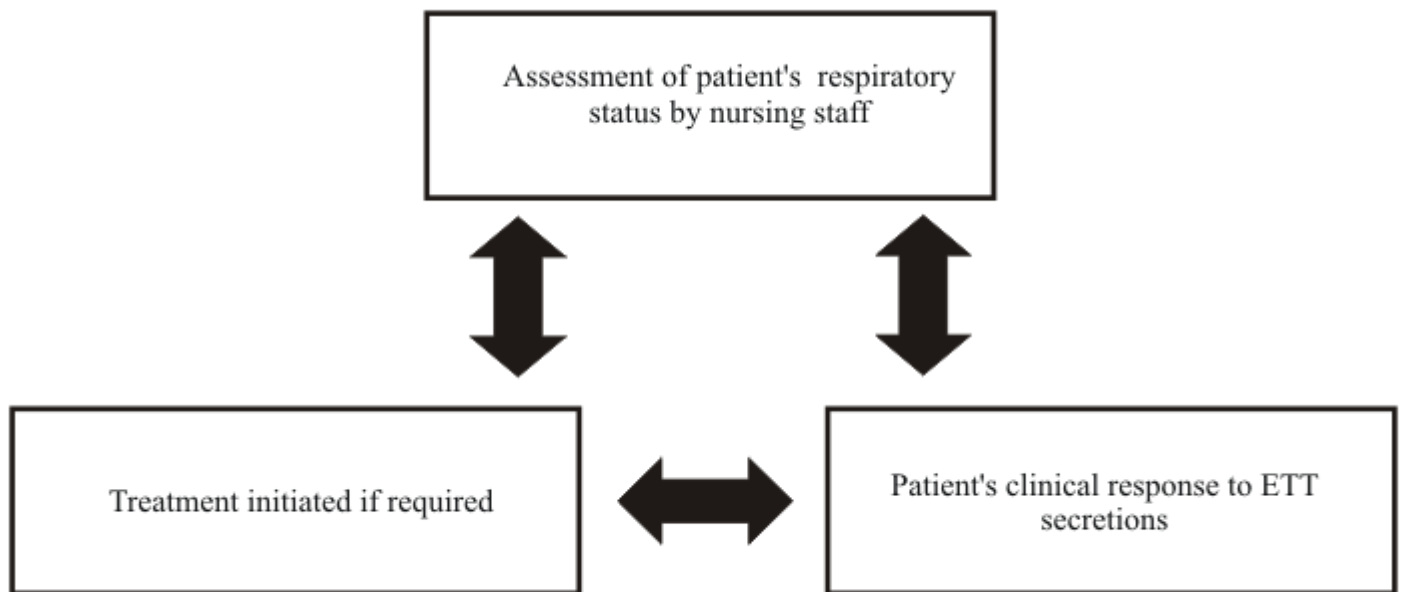


Figure 2. Nursing process model for this study (adapted from Marriner-Tomey & Raile-Alligood, 2002).

In summary, the conceptual framework for this study was based on Orlando's Nursing Process theory (Figure 3). The study followed these concepts in the development of the Endotracheal Suction Assessment Tool (through Phases 1 to 4). The experienced nurse within this framework recognises the need of the paediatric intubated and ventilated patient for endotracheal suction based on identifiable criteria. It is expected that specific criteria can be established through a review of the literature and by gaining insight into the knowledge and principles experienced nurses use to assess the patient's respiratory status and need for endotracheal tube (ETT) suction. The identified criteria can then be used to develop an Endotracheal Suction Assessment Tool, which can be used to guide the nursing practice of ETT suction. The conceptual framework (Figure 3) includes additional processes of refinement, implementation and testing of the tool in the clinical setting which would be required for the further development of this tool beyond the scope of this Masters study.

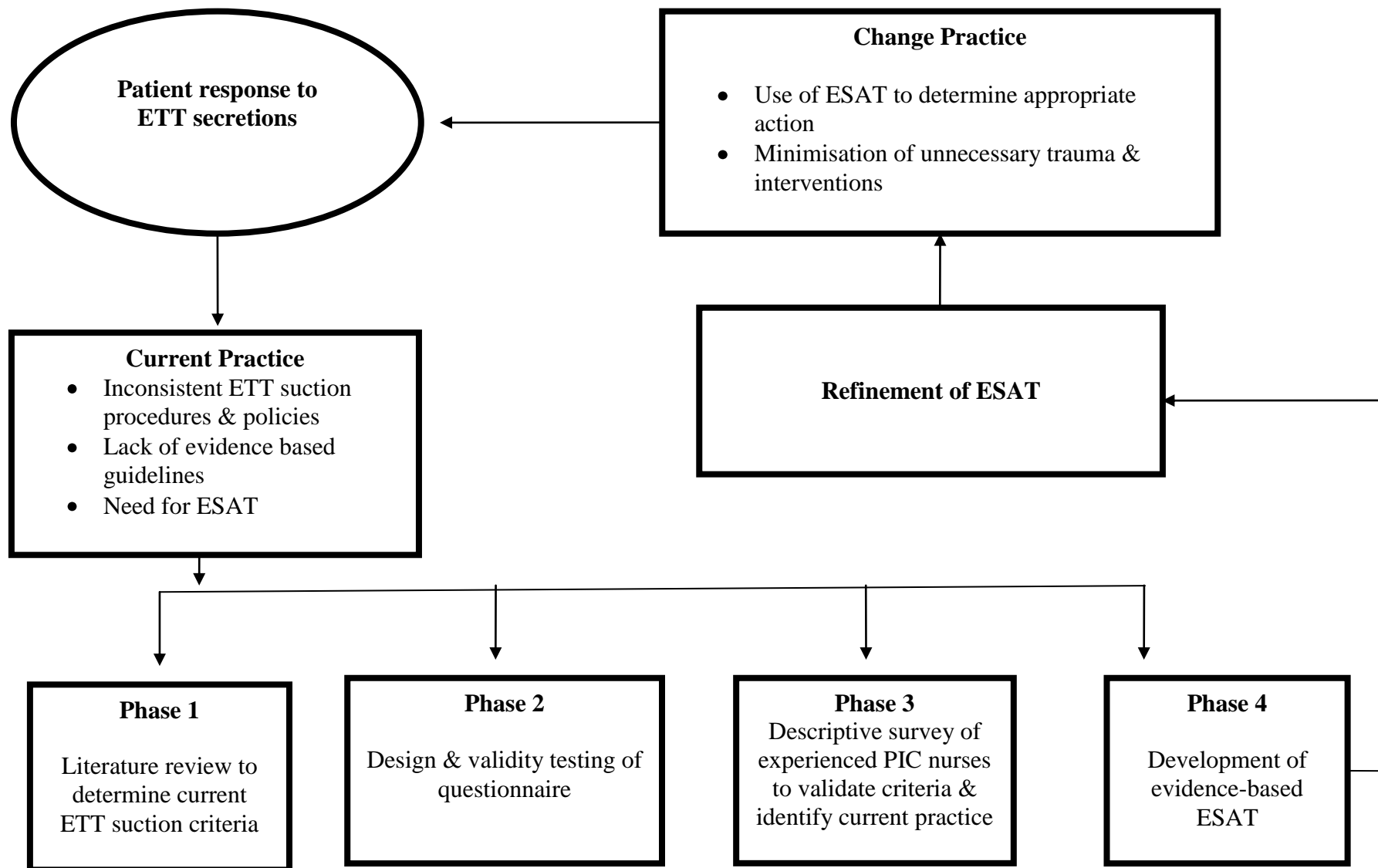


Figure 3. Conceptual framework (Adapted from Orlando's Nursing Process, 2005).

CHAPTER FOUR

METHOD

This chapter discusses the methods and procedures used to conduct the study. Ethical issues associated with conducting the study within Australia and New Zealand are also discussed. The study comprised four phases. Phases One to Three are discussed in sequential order. A brief outline of Phase One is included, as this phase was comprehensively discussed as part of the “Literature Review” in Chapter 2. The rationale for designing a study based on descriptive statistics using a questionnaire format is discussed. The setting, sample and procedures for Phase Two and Three are explained, as is the data analysis of Phase Two and Three. Phase Four will be discussed in depth in Chapter 6, as the results from Phase One to Three determined the design of the Endotracheal Suction Assessment Tool.

4.1 Design

A descriptive design incorporating both quantitative and qualitative research approaches was used.

Phase One - A literature review to determine currently used endotracheal tube suction criteria, followed by the design of an Endotracheal Suction Questionnaire based on the identified criteria.

Phase Two – Testing of the Endotracheal Suction Questionnaire for content validity, clarity, and apparent internal consistency by paediatric intensive care unit nurses at Princess Margaret Hospital for Children.

Phase Three – Administration of the Endotracheal Suction Questionnaire to experienced PIC nurses within Australia and New Zealand to contextualise and validate criteria identified in the literature review, and to identify current practice.

Phase Four - Development of an evidence based Endotracheal Suction Assessment Tool based on the findings from the previous phases of this study.

A methodology flow chart for each phase is shown in Figure 4. The following section explains each phase in detail.

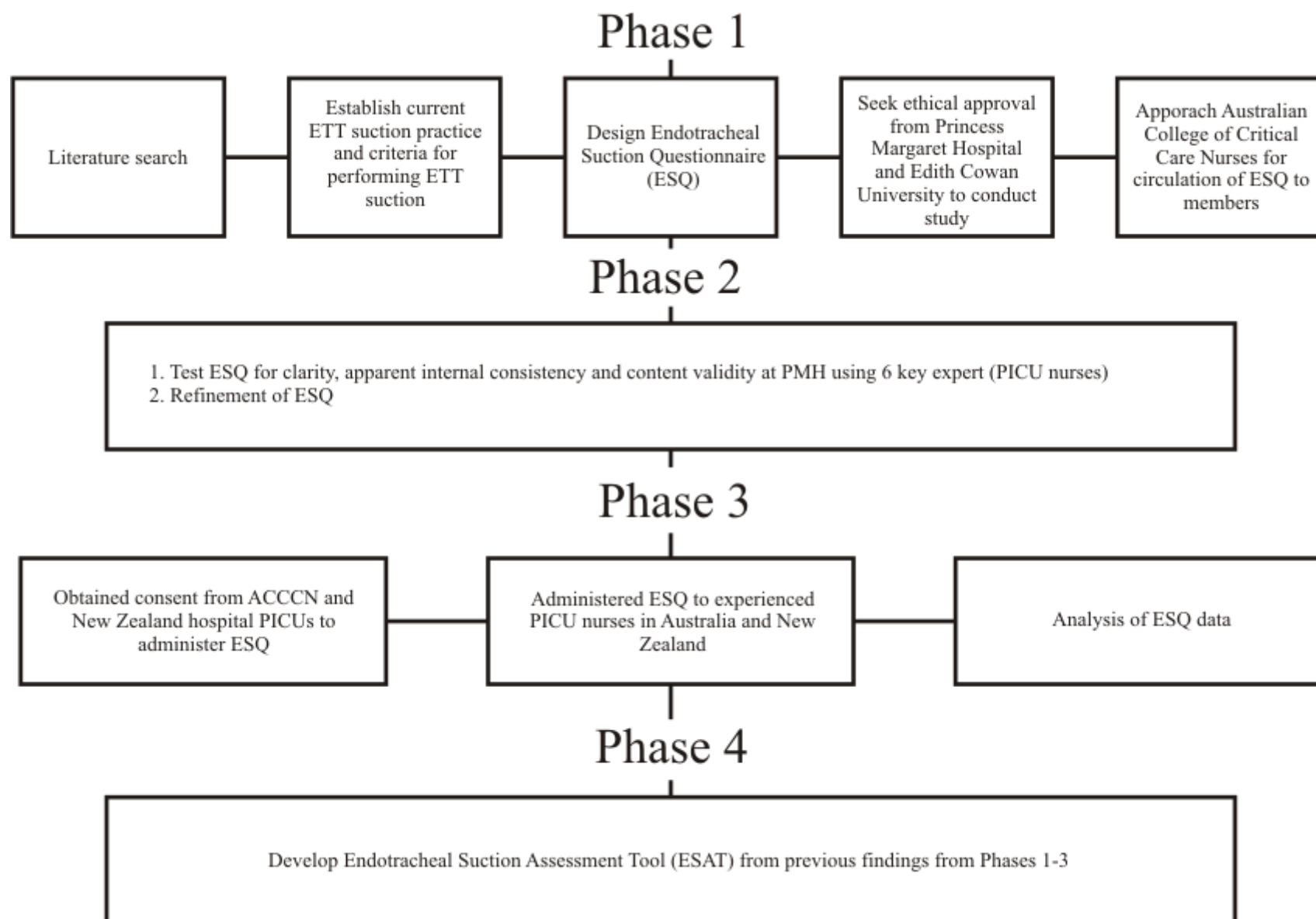


Figure 4. Study methodology flow chart.

4.2 Phase One

In the first phase of this study the available literature was reviewed and compared to identify criteria used for the performance of endotracheal suction (Table 2.6). The starting point for constructing an assessment tool required a basis for selection of potential criteria for inclusion or exclusion. A full and comprehensive study of all related literature to select current methods in use was selected as the most appropriate method to gather criteria to be further analysed in the specific context of the study. The most consistent and commonly used criteria were identified. As previously stated these criteria could be separated into four broad categories; “respiratory”, “ventilation”, “haemodynamic” and “physical descriptors”. These criteria were used as the basis for the development of a questionnaire to survey experienced nurses within paediatric intensive care units to determine whether practice correlated with the criteria presented in the literature. The 13 criteria selected for inclusion in the initial questionnaire design were “dyspnoea or signs of respiratory distress”, “auscultation: (altered, diminished, abnormal air entry)”, “decreased oxygen saturation/cyanosis”, “visible or audible secretions”, “decreased tidal volume delivery”, “increasing end tidal CO₂”, “increased peak pressure”, “haemodynamics (unexplained changes in heart rate/BP & ICP if applicable)”, “alteration in arterial blood gas results”, “coughing”, “altered chest movement”, “queried aspiration”, and “unexplained patient restlessness” (Appendix 10). To ensure the validity of these criteria for inclusion or exclusion in the questionnaire designed in Phase Two the questionnaire was tested for content validity, clarity and apparent internal consistency. A qualitative component was incorporated in the Endotracheal Suction Questionnaire to ensure identification of any other valid criteria beyond those initially included.

The title applied to the questionnaire was the Endotracheal Suction Questionnaire (ESQ).

4.2.1 Rationale for use and development of the endotracheal suction questionnaire used for this study.

The decision to use a questionnaire to survey paediatric intensive care nurses was made primarily because the researcher needed to elicit information from interstate and overseas participants and the written form was deemed the most appropriate and time efficient approach. For the purpose of this study, a combination of a descriptive and explanatory survey questionnaire was considered most appropriate as the research was aimed at identifying specific criteria attributed to current endotracheal suction practice in Australia and New Zealand PICUs and exploring the ranking of each criterion (Appendix 17). The researcher chose as the most practical approach for distribution of the questionnaire to participants was via mail, as administration face-to-face or via telephone was not possible due to geographic spread.

When designing a questionnaire survey, the type of questionnaire needs to be defined. The main objective or aim of a descriptive survey is to accurately portray attributes and characteristics associated with a certain individual, group, situation or process and explore the frequency of these attributes (Burns, 2000; Polit & Hungler, 1993); for example, the number of years the research participants have worked in paediatric intensive care. An alternative type of questionnaire as defined by Burns (2000) is the explanatory survey which “seeks to establish cause and effect relationships but without experimental manipulation.” An example of an explanatory survey would be the effect of nurses’ motivation on the use of the pain assessment tool. Advice was sought from the Princess Margaret Hospital (PMH) biostatistician and principal research supervisor regarding potential questionnaire format and design.

As previously stated, questions or items used in development of the questionnaire were based on the criteria identified from the literature review. These items were selected as scaling responses that could be identified and scored by direct estimation technique. Each criterion had direct application to the procedure under study and was unambiguous in the specific physiological attribute it was measuring. Further validation of these criteria for inclusion in the questionnaire was demonstrated through Phase Two and is explained further under section 4.2.3 “Questionnaire design - the qualitative component”.

The format of the questionnaire design required the participants to answer one question at a time using terminology each participant should be familiar with and

understand. The Visual Analogue Scale (VAS) (Appendix 1) was used for section two as it is widely used and accepted within the health industry (Streiner & Norman, 2005). The VAS consists of a fixed length line of 100mm. For question 8.2, the scale ranged from “not at all” (zero point of line) through to “always” (representing a score of 100). Each participant was asked to mark an X along the line at a point that best showed how often they used a specific criterion when determining if endotracheal suction was required. In section two, question nine, the scale ranged from “not at all important” (zero point of line) through to “very important” (representing a score of 100). Each participant was asked to mark an X on the line at the point which best showed how important they believed each criterion was in determining whether to perform suction. The VAS scale enables the quantification of subtle gradations between each criterion by the participants along the scale and levels of comparison can be made between the participant’s responses. A limitation of the scale is that participants’ answers may be based on socially or professionally acceptable views rather than actual current practice. There are participants who, regardless of the question under consideration, will always mark the scale at a particular point, either in the middle or at either end of the scale. Also some participants will agree with a question simply because it is being asked (Polit & Hungler, 1993; Streiner & Norman, 2005).

As stated previously, incorporation of a qualitative component may identify criteria that should be considered in the design of the Endotracheal Suction Assessment Tool that were not identified in the literature review. Further support for this component of the questionnaire will be discussed later in section 4.2.2 “Questionnaire design - the qualitative component”.

The advantage of using the questionnaire format enables confidentiality and anonymity to be maintained and access to large numbers of participants from diverse locations (Burns, 2000). Information gathered from a questionnaire can reflect an extended period of time and, if comparable with other participants, can identify patterns within data. The principles of questionnaire design require the application of appropriate tool development, strategies, and the testing for clarity, apparent internal consistency and content validity (Aamodt, 1983; Edwards et al, 2002; Lynn, 1986; Meadows, 2002). Clarity is required in defining the parameters involved to ensure that each question is clearly understood and unambiguous in its meaning. In addition, it is equally important to ensure the validity of the questionnaire content and the internal

consistency of the survey. Content validity ensures what the researcher is attempting to measure is actually being measured within the questions being asked and will be definable in the data obtained (Burns, 2000; Imle, 1997). Internal consistency is a form of reliability, and refers to the degree to which the questions are all measuring the same attribute and if they are relevant to the purpose of the questionnaire (Aamodt, 1983; Lynn, 1986; Meadows, 2002; Polit & Hungler, 1993). An advantage of the questionnaire format is the ease of testing for apparent clarity, internal consistency and content validity before distribution enabling the researcher to adjust the design if required. Questionnaires are also a cost effective method when responses are being elicited from national and overseas participants, as in this study. Each participant receives an identical set of questions in an identical format; therefore eliminating the potential influence of an interviewer or third party to direct answers or transcribe responses incorrectly. Finally the participant can answer the questionnaire in their own time at their own pace.

Although use of a questionnaire was considered the best approach for this study, it is acknowledged there are a number of potential disadvantages with this technique. Limitations in using a VAS scale were acknowledged earlier. Information gained through the questionnaire method are potentially open to bias if all questionnaires are not returned, and the motivation for participants completing or not completing the questionnaire will remain an unknown quantity. Unless the researcher is contacted, the inability for participants to seek clarification for any question may lead to ambiguous or inaccurate results. A deficiency in the quality of the questionnaire may elicit a negative response from the participant or result in misinterpretation of the question leading to ambiguous, incomplete or inaccurate data being collected. The participants may also find the questionnaire inflexible and limiting in detailing all the information associated with the specific question asked (Burns, 2000). These disadvantages may explain why response rates can be as low as 15% (Burns, 2000; Edwards et al, 2002). If the response rate is low then sampling errors and bias may affect the reliability of the data collated. The testing phase of this study was included as a means of ameliorating some of these issues.

Despite the limitations associated with use of a questionnaire it was considered more appropriate than conducting interviews for several reasons. First, the large sample size and the time constraints of a master's study limited the range of practical options. Second, there would be less opportunity for bias using this approach than an

interview. Finally, to overcome the previously mentioned potential for inflexibility and limiting detailing in relation to the questions asked and the obtained data, a qualitative component (i.e. two open ended questions) was included. These factors were considered during the design and validation process of the questionnaire and are further discussed in section 4.3.

4.2.2 Questionnaire design - the quantitative component.

As previously discussed in the literature review, there was a lack of consensus and a wide variety of clinical observations or criteria cited within the literature as rationales for performing endotracheal tube (ETT) suction. To identify and demystify standard practice within the paediatric intensive care units (PICUs) within Australia and New Zealand, the Endotracheal Suction Questionnaire (ESQ) was designed primarily using closed questions that could be analysed using descriptive statistical techniques.

Descriptive statistics is a quantitative method of analysis that can be used to measure practice mathematically (Burns, 2000; Munro, 2001; Rowntree, 1991). Measurement of specific variables is an essential element to scientific research (Streiner & Norman, 2005). For a variable to be measurable, it requires a clear definition of the variable in terms that can be measured, an important consideration in any tool design.

Levels of measurement can be categorised as nominal, ordinal, interval or ratio (Burns, 2000; Munro, 2001; Rowntree, 1991; Streiner & Norman, 2005). Nominal scales categorise the object according to some property, for example the title given to a neonatal or paediatric intensive care post-graduate qualification. Ordinal scales rank the order of a variable along a specific scale but do not quantify the differences between the rankings. For example the staff designation of the participant completing the questionnaire; one Clinical Nurse may have 2 years experience in the role, whereas another Clinical Nurse may have 20 years experience. Interval scales order objects according to the magnitude of some property they possess according to established equal differences between the unit of measurement (e.g. the pH reading of an arterial blood gas result). Ratio scales provide the highest level of measurement and possess all the characteristics of nominal, ordinal and interval scales but in addition have an absolute zero point. An example of a ratio scale would be the

percentage scale used for oxygen saturation measurements. These categories of measurement have direct implication on the type of statistical technique used in analysing the data collated. Finally, the distribution of data (i.e. normal or non-normal) will determine whether a parametric or an equivalent non-parametric statistical technique should be used (LoBiondo-Wood & Haber, 2006; Munro, 2001).

The ESQ was designed to include two sections that comprised in total 39 quantitative questions (Appendix 17). The first section contained seven questions relating to demographic information. These questions required categorical judgement by the participants and used either nominal or ordinal scales of measurement. They required the participant to provide information about their work designation, age, gender, number of years working within paediatric intensive care, experience in other critical care areas, postgraduate qualifications and to state their current hospital employer. Collection of demographic information was important to ensure the sample participating in the questionnaire reflected the target group for the study. For this reason, questions relating to number of years working within paediatric intensive care, experience in other critical care areas, postgraduate qualifications and their current hospital employment information were included in this section. These questions were also used to encourage completion of the ESQ because they eased the participant into the second section of the ESQ, where reflection on his/her individual clinical practice was required (Burns, 2000; Munro, 2001; Rowntree, 1991; Streiner & Norman, 2005).

Development of the quantitative component of the questionnaire involved identifying and defining the variables or items. The literature review was useful in establishing these variables and identifying their characteristics. After careful consideration of the reviewed literature and comments provided by the expert reviewers, the second section of the ESQ was designed to include 15 questions relating to respiratory assessment criteria and 15 questions rating the importance of the respiratory assessment criteria (Appendix 17). The questions incorporated language familiar to the participants' working environment, for example "dyspnoea". Specific terminology was essential for several reasons. First, the terminology related directly to the subject being researched and accounted for the knowledge base of the participants. Short succinct questions were used to minimise the participant's "boredom level" and make the ESQ easy to complete for busy nursing staff within limited time frames.

Direct estimation technique was identified as the most appropriate quantitative method to establish the magnitude of each variable. The participant's perception of how often they used a certain criterion in the process of endotracheal suction was of interest to the researcher as was his/her subjective view of the importance of each criterion (Polit & Hungler, 1993; Streiner & Norman, 2005).

Scatter plots can be used to explore the relationship between two continuous variables, for example the age of the patient and their feelings of well being. The scatter plot can provide a general indication of the strength of the relationship between the two variables. In a weak relationship the points will be scattered across the graph. In a strong relationship the points will be scattered more closely (LoBiondo-Wood & Haber, 2006). If the data points form a straight line going from the origin out to high "x" and "y" values, the variables are said to be positively correlated. If the line of data points goes from a high-value on the y-axis down to a high-value on the x-axis, the variables are said to be negatively correlated.

For this study the general indication of strength or correlation between the criteria used to perform endotracheal suction and their rating will be examined using scatter plots. The results reflect ordinal scale measurements and are therefore classified as nonparametric. Spearman rank order correlation coefficient (used for this study) provides a numerical summary of the direction and strength of the linear relationship between two continuous variables that are nonparametric. The size of the absolute value provides information on the strength of the relationship (Munro, 2001).

The use of quantitative research methods to determine the type of data required and the most appropriate format was essential for designing the Endotracheal Suction Assessment Tool (ESAT) for the clinical setting. In essence, closed questions were developed in order to determine which criteria were used in the performance of ETT suction, as well as the level of importance of each criterion.

4.2.3 Questionnaire design - the qualitative component.

The third section of the questionnaire comprised two open ended (qualitative) questions. As previously stated, these were:

1. Describe as fully as possible a recent ETT suction experience you performed. Include in your description the specific factors that influenced your decision to perform endotracheal suction for this patient.
2. What criteria (other than you have described above) do you personally consider when determining if a child requires endotracheal suction? (e.g. alteration in the pressure curve on the graphic display of the ventilator).

Qualitative research originated from psychology, anthropology and sociology disciplines. There are differing qualitative methodologies used to examine differing aspects of human interaction, communication, behaviour, culture and a person's lived experience (Burns, 2000; Liamputtong & Ezzy, 2005; Polit & Beck, 2004).

Qualitative research is undertaken in the context of the experience, generating data that relates to an individual event and in relation to the realities of an individual's viewpoint. It may concern a limited focus or generate a picture that incorporates a larger theme. Qualitative research can give insight into the motivation behind an action that the individual may not even be consciously aware of. As it brings these concepts out into the open they can generate a rationale for an action, and raise new questions or challenge theories (Liamputtong & Ezzy, 2005; Polit & Beck, 2004). In the context of this study it was anticipated that providing nurses with the opportunity to provide subjective insight about their ETT suction practice may "shed some further light" about what attributes/practices inform the experienced practitioner's clinical practice. This allowed for further definition of issues and facilitated reflection on the endotracheal suctioning process by potentially identifying criteria previously unidentified within the literature or listed in the questionnaire. Figure 5 gives a brief overview of a number of qualitative theories, which could be used to analyze the free text component of the questionnaire.

Qualitative Theory	Definition
Grounded theory	Aims at collecting and analysing qualitative data developed from real world experiences that translate into theoretical propositions. The theory is grounded in the social processes that occur within human interaction (Broussard, 2006; Speziale & Carpenter; 2007).
Ethnography	The study of cultural patterns focusing on the cultural frameworks that guide and make sense of a person's action (Burns, 2000; Liamputtong & Ezzy, 2005; Polit & Beck, 2004).
Symbolic interactionism	Examines how common sets of symbols define the sense of the experience (Liamputtong & Ezzy, 2005).
Hermeneutics	Clarifies the condition in which understanding takes place (Koch, 1995).
Phenomenology	A philosophy and research method aimed at exploring through essential description of the phenomena under study (Donalek, 2004; Taylor, 1995). Phenomenology studies situations in the everyday world from the viewpoint of the experiencing person which adds understanding by providing a comprehensive description of the action as to why people do the things they do. The understanding can only come from the context of the routine interaction with the world (Liamputtong & Ezzy, 2005).
Content analysis	A process analyzing written or verbal communication in a systematic and objective fashion, with the goal of identifying qualitative variables (Burns, 2000; Liamputtong & Ezzy, 2005; Polit & Beck, 2004). Any categories and variables not already identified from the literature are searched for in the written accounts provided by the participants.

Figure 5. Traditional qualitative theories and definitions.

A descriptive qualitative approach was incorporated using content analysis to ensure the criteria identified for initiating endotracheal suction were complete (Drennan, 2003; Reed, Proctor & Murray, 1996). Content analysis was used to identify the specific variables most commonly described by participants. The content analysis process used in this study followed the principles outlined by Liamputtong and Ezzy (2005) as follows:

- Identify relevant criteria (codes) from the literature matching that appearing within the data.
- Select the sample to be categorised
- Count, or systematically record, the number of times the categories occur that were sighted in the literature.
- Identify relevant criteria (codes) not matching the literature and repeat above process.

The focus of this research was to examine the collective view of the nurses' experience with patients in the performance of a routine procedure. The intention was to determine why the procedure was instigated from the perception of the nurse. In using a written descriptive account the researcher may discover meanings about the procedure being researched. Recollection of an event implies that what can be recalled constitutes meaningful significance (Kleiman, 2004). By collating specific experiences and associated physical observations, the researcher can establish physical measures for specific indicators that are used for nursing judgement of whether it is necessary to instigate the endotracheal tube (ETT) suctioning procedure. In deconstructing the data obtained from experienced practitioners criteria that may possibly have previously been missed, may be identified.

The integration of a quantitative based questionnaire with a qualitative based component (using content analysis), may help to identify what is specifically involved in nursing judgement when making an assessment that results in the suction of the endotracheal tube (Higgenbottom, 2004; Priest, 2002).

In summary, this study design used a combination of quantitative and qualitative methodologies in the format of a questionnaire to ensure all relevant criteria were identified for inclusion into the Endotracheal Suction Assessment Tool (ESAT) design. Criteria not previously identified from the literature review but used within Australian and New Zealand paediatric intensive care units to determine if

ETT suction was required were identified. These new criteria were considered for inclusion into the ESAT and will be discussed further in Chapters 5 and 6.

4.3 Phase Two

To determine whether the newly developed and hence untested Endotracheal Suction Questionnaire (ESQ) adequately addressed the research questions of this study and comprehensively identified the relevant criteria, pre-testing of the questionnaire was undertaken to ensure clarity of questionnaire items, content validity and apparent internal consistency (Burns, 2000; LoBiondo-Wood & Haber, 2006).

4.3.1 Setting.

This phase involved recruiting experienced nurses from the Paediatric Intensive Care (PIC) unit at Princess Margaret Hospital (PMH) for children, which is the sole level three paediatric intensive care unit within Western Australia. The PICU provides care for approximately 750 critically ill newborns, children and adolescents per year from all areas of the state of Western Australia. Of this number, an average of 35% (n=263) patients require intubation due to their clinical condition annually. There are 10 beds in the PICU, and a full time equivalent of 38.0 nursing staff.

4.3.2 Sample.

The sample comprised six experienced PIC nurses. The inclusion criteria were as follows:

- experienced nurses (defined as having at least 5 years PIC nursing experience)
- with/or without a postgraduate qualifications in paediatric critical care

4.3.3 Procedure.

Permission to approach nurses was sought and granted from several sources prior to the testing process. The Executive Director of Nursing Services at PMH was initially informed and approved the proposed nursing research and requirements for

this phase of the study which would be conducted at PMH. The PICU's Medical Director and Clinical Manager were also approached with the same information. Following this initial approval process at the clinical level, ethical approval to conduct this phase of the study was obtained from the Human Research Ethics Committee of Edith Cowan University (Appendix 2) and PMH (Appendix 3).

The study aim and a request for participation from suitably qualified PIC nurses were advertised within the PICU at PMH using a poster display. The poster clearly defined the aim of the proposed research and the participant's role in phase two. Detachable "interest in participation forms" were attached to the poster with an explanation on how to return the completed forms to the researcher. The forms requested nurses' names, contact details, years of experience in PIC and the type of postgraduate qualification held, if any.

Review of all returned "interest in participation forms" showed six nurses to be suitable potential participants because they met the preset criteria of "expert" PICU nurse. These expert reviewers represented a cross section of experienced staff working within the PICU at PMH. There were three male and three female nurses; two were clinical educators, five had postgraduate certificates in paediatric intensive care and all had over five years clinical experience in PICU.

Each reviewer was given a hand delivered information package from the researcher containing:

1. An outline of the research proposal (Appendix 4).
2. A check list detailing the package contents (Appendix 5).
3. The researcher's contact details for any queries about the process and the due date for return of the completed checklists (Appendix 5).
4. Consent form (Appendix 6).
5. Checklist A: Testing the clarity of the Endotracheal Suction Questionnaire instruction and response sheet (Appendix 7).
6. Checklist B: Testing content validity of the Endotracheal Suction Questionnaire - instruction and response sheet (Appendix 8).
7. Checklist C: Testing internal consistency of the Endotracheal Suction Questionnaire instruction and response sheet (Appendix 9).
8. The Validity Testing Endotracheal suction Questionnaire (Appendix 10).
9. A stamped self addressed envelope to return the completed checklists.

Participants were instructed to:

- read the information sheet
- sign the consent form
- read the questionnaire without answering any questions
- complete the three checklists
- contact the researcher if any questions arose
- return the consent form and completed checklists by the due date (either by mail using the stamped self addressed envelope or hand deliver the sealed envelope to the researcher)

In summary, validity testing of the questionnaire for apparent internal consistency, content validity and clarity was undertaken with six experienced nurses from the paediatric intensive care unit (PICU) at Princess Margaret Hospital (PMH) in September 2006.

4.3.4 Data analysis – phase two.

Validity testing for Phase Two used the methodology described and validated by Imle and Atwood (1988) to assess the clarity, content validity and the internal consistency of the Endotracheal Suction Questionnaire (ESQ).

Clarity of a questionnaire refers to each question being clearly understood and unambiguous in its meaning. For example, avoiding the use of abbreviations that may differ in meaning between institutions or even different branches of the same organisation – for example TOF (McGibbon, 1997). If one is working in cardiology TOF would mean Tetralogy of Fallot, compared with Tracheo-Oesophageal Fistula if working in respiratory medicine. Agreement of 83% (i.e. five of six experts rating the item acceptable) was the preset minimum. This criterion was based on calculating the proportion of experts who might agree, out of the total number planned for use, and then setting the standard error of the proportion to identify cut-off for chance versus real agreement. Observable physical responses can be defined and measured (such as a rise in heart rate) however when defining abstract concepts such as anxiety, it does not necessarily represent a quantifiable and consistent measure of the level of anxiety itself (Streiner & Norman, 2005). When designing the ESQ it was essential each

question clearly defined what was required from each participant and was unambiguous in its explanation as to how to complete the ESQ so we can specifically measure a consistent quantifiable response across the participants. Internal consistency, therefore, refers to the degree in which each item is measuring the critical attribute of interest only (Munro, 2001; Polit & Hungler, 1993). For example, if a research tool was designed to examine arterial blood gas results then it would be inappropriate to include a question on venous blood gas results.

The average correlation of items or variables in a particular concept represents internal homogeneity that serves as a basis for estimates of internal consistency and content validity (Imle & Atwood, 1988). The reasoning behind reviewing for internal consistency is to look at each question in the questionnaire to ensure they belong together and that the initiation of treatment is based on the observed responses to the need for suctioning to occur. Experts were asked two questions: “Do these items generally belong together?”, and “Does each question belong in the questionnaire?” Space was also provided for experts to comment on items. The same priori criterion that was used to determine clarity was used to judge whether or not an item met apparent internal consistency reliability requirements (agreement of at least five of six reviewers).

Lynn (1986) identified a content validity index which necessitates a minimum of six experts within the field of the research topic are required to validity test the questionnaire. Lynn (1986) explained also that to avoid agreement through chance alone, a minimum of five experts would provide sufficient control. As previously stated “experts” have been defined for the purpose of this study as nurses with at least 5 years PIC nursing experience and/or postgraduate qualifications in paediatric critical care.

The final stage involved providing experts with definitions and concept labels for the subscales and asking them to make judgements about the content validity of the items individually and as a set. Experts were asked firstly: “In general, do the label and definition fit the whole set of questions in the questionnaire?” and “Does each question fit the label and definition?” They responded by circling yes or no next to each item.

The question of redundancy was addressed by asking the reviewers to indicate “Is the question unique (i.e. not repetitive?).” Space was provided for comments. A final question asked reviewers to add any items they considered to be missing from

the scale. Any new unique criteria that arose were considered for inclusion to ensure as complete a range of suitable criteria as possible for the questionnaire.

In summary, the preset minimum for agreement between the “expert” reviewers was set at 83% to validity test the Endotracheal Suction Questionnaire (ESQ) for Phase Two. Methodology described and validated by Imle and Atwood (1988) was used to assess the clarity, content validity and the internal consistency of the ESQ. New criteria identified by the reviewers for inclusion into the questionnaire was considered by the researcher and either included or excluded in the adjustment of the questionnaire (Appendix 17).

4.4 Phase Three

Phase Three involved the distribution of the Endotracheal Suction Questionnaire (ESQ) to nurses from within Australia and New Zealand who met the selection criteria. A survey of the eight tertiary hospitals from within Australia and New Zealand with paediatric intensive care units (PICU) established full time employment figures which were combined with best practice regarding staffing mix to estimate the potential number of participants (ACCCN, 2003; Blegen, Goode & Reed, 1998; Clark, 2002; Hall, Doran & Pink, 2004; Joint Faculty of Intensive Care Medicine, 2003; Lang, Hodge, Olson, Romano & Kravitz, 2004; Lankshear, Sheldon & Maynard, 2005; Pilcher, Odell, Bray, Clarke, Gardner, Orr & Stirton, 2001; Spetz, 2001; Williams & Clarke, 2001). Australian participants were recruited through the Australian College of Critical Care Nurses (ACCCN) and New Zealand participants were recruited from the Starship Children Hospital in Auckland.

4.4.1 Setting.

There are 16 hospitals that provide care for paediatric intensive care patients within Australia and New Zealand. Of these, eight are classified as tertiary and eight as secondary hospitals. The eight hospitals classified as tertiary are Princess Margaret Hospital for Children in Western Australia, the Women’s and Children’s Hospital and South Australia, the Royal Children’s Hospital in Victoria, the New Sydney Children’s Hospital at Westmead in New South Wales, the Royal Children’s Hospital

in Queensland, the Mater Misericordiae Children's Hospital in Queensland and Starship Children's Hospital in New Zealand. Tertiary hospitals were selected as they provide specialised consultative care, are the tertiary referral centres for other metropolitan or regional services with children needing intensive care, are self contained facilities providing complex, multi-system life support for protracted periods, leaders in their field and are university affiliated. They are potentially configured to give continuous ongoing practical experience to nurses in this area where as other hospitals would tend to be limited to stabilisation and transfer on to these hospitals. The most suitable candidates fulfilling the experienced paediatric intensive care nurse criteria would more likely come from these tertiary hospitals.

4.4.2 Sample.

The target group for inclusion in the study were experienced nurses working within tertiary paediatric intensive care units from within Australia and New Zealand. These nurses would be involved in providing direct clinical care of the critically ill paediatric patient. Part of their clinical practice would be patient assessment and the provision of endotracheal tube suction, Table 4.1.

It was considered practical to recruit participants in Australia through the Australian College of Critical Care Nurses (ACCCN). The ACCCN membership database was used to identify potential participants within Australia. Unfortunately, this database comprised 1800 members and was not sophisticated enough to identify solely the target group required. Therefore, in order to target all ACCCN members who may have met the experienced paediatric intensive care nurse criteria it was necessary to mail the Endotracheal Suction Questionnaires (ESQ) to all 1800 members. Due to the requirement to include all ACCCN members it was expected the overall response rate would be low when compared with the total number of questionnaires distributed.

Analysis of the Australian data results highlighted the need to target a further important and experienced group of nurses which had not met the initial selection criteria. These were experienced nurses who were involved in the emergency treatment, stabilisation and transport of the critically ill paediatric patient to tertiary hospitals. It was considered by the researcher that since these nurses were actively involved in the care of the critically ill paediatric patient, they could provide

invaluable information relevant to the study due to their clinical expertise, experience and knowledge. Therefore the selection criteria were modified at this time to include these experience practitioners (Table 4.1).

Table 4.1

Initial and Modified Selection Criteria for Inclusion in the Study

Initial selection criteria	Modified selection criteria
Australia and New Zealand tertiary paediatric hospitals	Australia and New Zealand tertiary paediatric hospitals
Experienced paediatric-nursing staff working within a paediatric intensive care unit	Experienced paediatric-nursing staff working within a paediatric intensive care unit
Experienced nurse definition: 5 years or more current clinical experience in paediatric intensive care or a postgraduate certificate in paediatric intensive care	Experienced nurse definition: 5 years or more current clinical experience in paediatric intensive care or a postgraduate certificate in paediatric intensive care
	Experienced nursing staff involved in the stabilisation and transport of the critically ill paediatric patient to a tertiary based intensive care unit within Australia

It was estimated from a survey of the full time employment figures from the PICU of each tertiary hospital, there were approximately 780 paediatric intensive care nurses. Australian data for best practice regarding appropriate staffing mix suggests a minimum of 50% of a PICU's nursing staff population should meet the criteria of experienced PIC nurse for the purpose of this survey (ACCCN, 2003; Joint Faculty of Intensive Care Medicine, 2003; Williams & Clarke, 2001). Based on English, Canadian and American studies, 30% of a PICU's nursing staff population should meet the criteria of experienced PIC nurse for the purpose of this survey (Blegen, Goode & Reed, 1998; Clark, 2002; Hall, Doran & Pink, 2004; Lang, Hodge, Olson, Romano & Kravitz, 2004; Lankshear, Sheldon & Maynard, 2005; Pilcher, Odell, Bray, Clarke, Gardner, Orr & Stirton, 2001; Spetz, 2001). As a conservative estimate,

a total of 235 personnel for this study would have met the experienced nurse criteria from within the tertiary hospitals in Australia and New Zealand. It was hoped that a minimum response rate of 20% would be achieved to ensure reliability and validity of the data collated (Burns, 2000).

Given the time constraints of a Masters by Research thesis, it was considered most expedient to recruit participants in Australia through the Australian College of Critical Care Nurses (ACCCN). This avoided the potentially time consuming task of applying for ethical approval from the other 15 hospital ethics committees. The researcher was aware that recruitment through the ACCCN could result in a sample of PIC nurses who were potentially more motivated to actively participate in studies than non-members, and that it was not possible to distinguish ACCCN members who specifically met the study inclusion criteria. While this may be considered a bias, the ease of accessing potential participants and meeting the time constraints of the study justified this recruitment strategy.

Following validity testing and refinement of the Endotracheal Suction Questionnaire (ESQ) (Appendix 17), the questionnaire was distributed to nurses in Australia and New Zealand. To maximise recruitment of participants meeting the selection criteria across a diverse demographic, nurses in Australia were contacted using details from the ACCCN database. New Zealand nurses were recruited from those working within the paediatric intensive care unit (PICU) at the Starship Hospital, which is the sole level three PICU in New Zealand.

4.4.3 Procedure.

The ACCCN was approached for permission to identify potential Australian study participants using the College's member database. Permission was granted (Appendix 11). The College accessed the database and provided the required member information in the form of an addressograph sticker for each member with his/her name and address. Information packages that included information for research participants (Appendix 14) and the questionnaire (Appendix 17) were mailed to members using the addressograph stickers. Pre-paid addressed envelopes were included for return of the ESQs to the researcher.

Participants were also recruited from the Starship Hospital which is the sole dedicated Paediatric Intensive Care (PIC) tertiary facility in New Zealand. The PICU

has a nursing staff full time equivalent number of 68.5 to service a 16 bed unit, which has approximately 1000 admissions per year. The PICU also provides a retrieval service for New Zealand and the South Pacific. The Director of Nursing (DON) of the Starship Hospital (Ms T Campbell) was contacted via telephone by the researcher who outlined the study, detailed the assistance required from the hospital and obtained verbal consent. Following this initial telephone contact an explanatory letter about the study was sent with information addressing the issue of study support and requesting written permission to contact staff within the unit (Appendix 12). Subsequently, the DON sent an email to the researcher indicating consent for the study to proceed (Appendix 16).

In summary, the Endotracheal Suction Questionnaire (ESQ) was distributed to all nurses from within Australia on the ACCCN database, with the aim of recruiting those nurses who met the selection criteria within this group, as it gave the most efficient access to the appropriate demographic. In New Zealand, the Starship Hospital PICU was used to access nurses who met the selection criteria. It was estimated there were potentially 235 candidates fulfilling the experienced paediatric intensive care nurse criteria. This figure was based on the full time employment figures from the eight tertiary hospitals from within Australia and New Zealand and Australian, English, Canadian and American best practice staffing mix studies.

4.4.4 Data analysis – phase three.

Quantitative data were analysed using the SPSS (Version 12) program. Demographic data and numeric variables within section two of the ESQ were analysed using descriptive statistics. Univariate statistical techniques were used to compare relative rankings of respiratory assessment techniques. In essence, the data were analysed and interpreted to gain quantifiable information related to the topic being researched (Burns, 2000; Munro, 2001; Polit & Hungler, 1993).

Advice was sought from the biostatistician of Princess Margaret Hospital to determine whether further analysis should be performed on the quantitative data. The suggested focus was to identify the central point of distribution for each question by establishing the measures for central tendency and use of Spearman rank order correlation coefficient to analyse the strength of the relationship between the use of each criterion and the rating of importance of that criterion.

Results of descriptive statistics performed on categorical variables within the demographic section of the ESQ are reported as number and percentage, and for numeric variables within section two of the ESQ as mean, standard deviation. The direction and strength of the relationship between the 15 variables relating to how often these criteria were used when determining if endotracheal suction is required and these 15 variables rating in level of importance when determining to perform suction were analysed using Spearman's Rank Correlation Coefficient (r_s). Results are presented as scatter plots and correlation coefficients (Rho) in Chapter 5. The significance of the relationship (r_s) between variables was tested using the Kolmogorov-Smirnov statistic. The significance level was set at 5%. The following guidelines were used to interpret the direction and strength of the relationship between variables:

- Rho = 0.10 to 0.29 or – 0.10 to -0.29: small correlation.
- Rho = 0.30 to 0.49 or – 0.30 to 0.49: moderate correlation.
- Rho = 0.50 to 1.0 or – 0.50 to – 1.0: strong correlation (Pallant, 2005).

Qualitative data from the two qualitative questions (questions 10a and 10b) were analysed using content analysis principles. This approach enables large amounts of richly detailed subjective data to be analysed by identification of major categories that best describe the phenomenon under study (LoBiondo-Wood & Harper, 2006; Speziale & Carpenter, 2007). Data from the two open ended questions were transcribed verbatim by the researcher, with all participant responses for each question aggregated into two separate text files. Transcribed data were then analysed by identifying, coding and categorising patterns within the written text (Liamputtong & Ezzy, 2005). Further explanation of the process and results are described fully in Chapter 5.

In summary, quantitative data analysis involved descriptive statistics for the demographic component of the data and univariate statistical techniques to compare relative rankings of respiratory assessment techniques. Spearman rank order correlation coefficient was used to analyse the strength of the relationship between the use of each criterion and the rating of importance of that criterion. Qualitative data analysis from the two qualitative questions (questions 10a and 10b) were analysed using content analysis principles. The results from both the quantitative and

qualitative data analysis will be used in the design of the Endotracheal Suction Assessment Tool and will be discussed further in Chapters 5 and 6.

4.5 Ethical Issues Associated with the Conduct of the Study

Approval to conduct all phases of the study was obtained from the Ethics Committee of Edith Cowan University. Approval to conduct Phase Two of the study (validity testing of the Endotracheal Suction Questionnaire) at Princess Margaret Hospital (PMH) was obtained from the PMH Ethics Committee (Appendix 3). For Phase Three in Australia, approval to distribute the ESQ using the Australian College of Critical Care Nurses (ACCCN) database, was obtained from the Executive Committee of the ACCCN (Appendix 11). In New Zealand, approval for the conduct of Phase Three required the approval from three separate parties: the Northern Y Regional Ethics Committee, the regional Maori council and the Management Committee at Starship Hospital for the New Zealand hospital. The specific application process for approval in New Zealand is mandatory by the terms of the “Treaty of Waitangi,” where cultural considerations are of significant importance and legally guaranteed. Ethical approval required complete disclosure of any sensitive or culture specific questions. It is a requirement that any hospital based research has a researcher nominated from within the area being researched to ensure cultural sensitivity is maintained. The Starship Hospital’s Research Nurse for the PICU (Ms L Whelan) agreed to be on-site researcher and assisted with gaining ethics approval. New Zealand ethics approval was therefore obtained from the Northern Y Regional Ethics Committee, the regional Maori council and the Management Committee at Starship Hospital for the New Zealand hospital (Appendix 18).

Participation in the research study was voluntary. A postal service was used to distribute the questionnaires within Australia ensuring the researcher had no contact with the questionnaires once labelled. Participants within Australia who chose to participate in Phase Three were asked to complete the ESQ and return it to the researcher using an addressed reply paid envelope. Consent was implied by the return of the completed questionnaire and no names were required on the ESQ. Thus, anonymity was ensured for all participants.

In New Zealand an information package was provided to each potential participant by the Starship Hospital's PICU research nurse. The information package included information for the research participants (Appendix 15), the questionnaire (Appendix 17) and a return envelope for the completed ESQ. Each participant was asked to complete the questionnaire and return it within a two week period to the Starship Hospital's PIC Nurse Researcher in a sealed envelope. Consent was implied by the return of the completed questionnaire to the researcher. The New Zealand research nurse was not responsible for ensuring the questionnaires were completed. To maintain the anonymity of the New Zealand participants no identifying information was included on the questionnaire or return envelopes with the exception of Ms Whelan's name on the return envelope. Thus, no information could be traced back to an individual participant. After a period of four weeks, returned envelopes containing the questionnaires were packaged together and sent via post by the Starship PIC Nurse Researcher to the address of the Australian researcher.

Questionnaires were numerically coded at the time of data entry. As previously described, participants were neither identifiable, nor potentially identifiable. Raw data is stored in a locked cupboard in a locked office at Edith Cowan University to which only the researcher and supervisor (Associate Professor Leanne Monterosso) have access.

In summary, the methods and procedures used to obtain and analyse the data have been clearly defined. Ethical considerations included measures employed to maintain anonymity and obtain voluntary consent, and consideration of cultural requirements. The following chapter presents the study findings.

CHAPTER 5

RESULTS

The statistical techniques used for content and validity testing of the Endotracheal Suction Questionnaire (ESQ) in Phase Two were described in the previous chapter. The results for Phases 2 and 3 will be presented. Since both quantitative and qualitative methods were used in Phase Three the results will be described separately.

5.1 Results - Phase Two

Phase Two testing was performed to ensure the ESQ adequately addressed the research questions of this study and comprehensively identified the relevant criteria. The results for Phase Two describe the clarity rating procedure, internal consistency rating procedure, the content validity procedure and the recommendations by the "expert" reviewers. These ratings and recommendations were analysed against a preset agreement criteria or potential for improvement of the questionnaire. The adjustment of the questionnaire resulted in the removal of one demographic question and the inclusion of two new criteria for each question in section two. The revised format of the ESQ is shown in Appendix 17.

5.1.1 Clarity rating.

The clarity rating procedure asked each reviewer to ensure the instructions for each ESQ question could be clearly understood.

Of the 36 items in the original Endotracheal Suction Questionnaire (ESQ) used for validation testing (Appendix 10) one item (question 7) achieved only 50% (three of six reviewers) agreement for clarity. This question asked "How would you describe the level of care within your unit?" Comments from three reviewers indicated the definition between the differences in level of care provided was unclear. After review of these comments by the researcher, the question was considered to be ambiguous and in addition, the information requested would not be useful in the context of the research. Thus, the item was subsequently removed from the questionnaire.

In using the descriptor “chocolate” for the examples on how to complete questions nine and ten one reviewer (16%) considered the use of this descriptor as inappropriate for the clinical setting. As the researcher considered this a valid point the examples were altered respectively to: “How often do you use the criteria of the patient’s weight before determining whether to give pressure area care?” and “How important do you consider the criteria of a patient’s weight before determining whether to give pressure area care?” These were considered to reflect examples appropriate for the clinical environment.

When reviewing the clarity of the wording for each question, three reviewers (50%) suggested changing the wording of questions 9g and 10g from “queried aspiration” to “suspected aspiration”. The researcher considered “suspected” was less ambiguous for general interpretation and inferred a clearer perception of a required nursing intervention. Therefore the terminology was changed accordingly (Appendix 17).

Question 11b “What criteria (other than you have described above) do you use for determining if a child requires endotracheal suction? (e.g. alteration in the pressure curve on the graphic display of the ventilator)” of the questionnaire was found to be unclear by two reviewers (33%) who offered suggested changes. The researcher considered these suggestions were valid and the question was adjusted to the following “What criteria (other than you have described above) do you personally consider when determining if a child requires endotracheal suction? (e.g. alteration in the pressure curve on the graphic display of the ventilator).”

5.1.2 Internal consistency rating.

For the internal consistency rating procedure the six reviewers were asked to review each ESQ question and decide if they thought they seemed to belong together. One reviewer expressed that questions 1-8 (demographic) did not “fit” or “belong” in the ESQ. The researcher considered the reviewer’s comments demonstrated a lack of experience/understanding of the need to include questions about demographic characteristics when designing questionnaires to determine whether the population sampled met the inclusion criteria. Since five (83%) of the reviewers agreed these demographic questions should be included (the preset criteria for apparent internal consistency), this reviewer’s comments were not acted upon.

5.1.3 Content validity.

For content validity each reviewer was asked to review the ESQ questions and decide if they thought they seemed to flow easily in a logical order. Of the 36 items reviewed, 28 items achieved 100% agreement, and eight items achieved at least 83% agreement. The eight items where there was 83% agreement were demographic questions. One reviewer did not believe the questions were valid, however, after consideration by the researcher it appeared the reviewer probably related these questions directly to the need to perform endotracheal tube suction rather than the gathering of demographic information.

Included in the content validity section each reviewer was asked to write down any questions they thought should be added to the questionnaire. Four reviewers (67%) suggested two new criteria should be included. These were:

- Endotracheal tube (ETT) suction performed due to suspected obstruction of the tube.
- The frequency of endotracheal tube suction was performed due to unit protocol or guidelines stating a set time limit between suction procedures.

These suggestions were considered by the researcher as valid points despite not achieving the preset 83% agreement as both had been cited in the literature. Moreover, an overarching aim of this study was to identify if there was a link between why ETT suction should be performed as recommended in the literature reviewed and current nursing practice. These two criteria were subsequently included in the questionnaire (Appendix 17).

To summarise, all but two of the 36 questions in the ESQ (Appendix 10) achieved the preset criteria of 83% for clarity; four others were adjusted in accordance with suggestions from the reviewers after due consideration of their appropriateness and two new criteria were added. The ESQ was adjusted by deleting question seven as it was deemed ambiguous and redundant. The examples for Questions nine and 10 were changed to appropriately reflect the clinical setting. “Queried aspiration” was changed to “suspected aspiration” to achieve an improved clarity in the terminology used. Question 11b was adjusted to improve the clarity of the question. Two additional criteria: “suspected obstruction of the endotracheal tube by secretions” and “frequency of endotracheal tube suction is set by unit protocol/guidelines” were added

to the ESQ as they were considered relevant to the study and covered criteria not previously included (Appendix 17).

5.2 Results - Phase Three

As previously stated, qualitative and quantitative data for Phase Three are presented separately. In the quantitative results section, those derived from demographic questions are presented first (Tables 5.1 and 5.2). Second, results from questions using the visual analogue scale about how often a specific clinical criterion was used when determining whether to perform endotracheal tube (ETT) suction and the importance of clinical criteria in determining whether to perform ETT suction were calculated and tabled as mean, standard deviation and median measures (Tables 5.3 and 5.4). Third, Spearman rank order correlation coefficient results are presented showing the relationship between how often the 15 criteria were used in determining the need for ETT suction and the rating of importance of each criterion when determining whether to perform ETT suction. Finally, scatter plots based on the above correlation between how often a criterion is used and its rating of importance provide visual clarification of these results.

Qualitative results were analysed using content analysis principles. In comparing the codes identified within the written responses with the codes identified from a review of the literature, four previously unidentified codes were found. These were: “history”, “combination of factors”, “treatments directly relating to airway manipulation” and “transport related”. When participants described other criteria they would consider using when determining whether to proceed with endotracheal suction, 13 codes were identified (Table 5.8).

5.2.1 Quantitative data.

A total of 261 (14.5%) Endotracheal Suction Questionnaires (ESQ) were returned to the researcher from Australian College of Critical Care Nurses (ACCCN) members within Australia. Of the returned questionnaires, 86 nurses met the selection criteria. Forty eight participants were from tertiary hospitals within Australia, representing 22.4% of the initial target group identified by the survey of fulltime equivalent PIC nurses employed in Australian paediatric tertiary centres (n= 214). Thus, the response rate of Australian participants from tertiary hospitals was considered to be 22% (n=48).

Thirty eight (44%) of the 86 Australian participants were working in emergency and retrieval services where they cared for children in a secondary hospital outside a major tertiary centre, or during transport of the critically ill child (where they provided care related to stabilization and transport) to the nearest appropriate tertiary paediatric intensive care unit. Half (n =19) of these participants indicated their designation as Clinical Nurse Specialist (CNS) and represented a very experienced nursing group with potentially a high degree of direct clinical experience with endotracheal tube suction. Comments made by the CNS, showed astute observations of the endotracheal suction procedure within the qualitative answers, showing their competence and experience in this area. These 38 participants met the modified selection criteria (Table 4.1) for the survey despite falling outside the initial projected target group of tertiary paediatric intensive care hospital nursing staff. They were involved in the important emergency care and transport of some critically ill paediatric patients to tertiary hospitals and had either a postgraduate qualification in intensive care or at least five years paediatric intensive care experience. The overall response rate for Australian nurses who met the modified selection criteria was unable to be determined as the potential numbers based on full time employment figures for this group could not be verified.

In New Zealand, 35 ESQs were distributed to nurses working within the Starship Hospital's PICU in accordance with the selection criteria. Eighteen completed ESQs were returned representing a 51% response rate. In total 104 completed ESQs were returned and subjected to analysis.

5.2.2 Demographics (Table 5.1).

Of the 104 participants, 92 (88%) were female and 11 (11%) were male (missing data n=1). The age of participants ranged from 20-25 years (n=1, 10%) to >50 years (n=12, 11.5%). Twenty two percent (n=23) of participants were aged between 36-40 years and 25% (n=26) of participants aged between 41 and 45 years of age. Most participants were identified as either Registered Nurses (n=40, 38.5%) or Clinical Nurse Specialists (n=37, 35.6%). The Clinical Nurse Specialist is defined differently between states and territories within Australia. The role can be the equivalent of a Clinical Nurse Consultant, Charge Nurse, Clinical Nurse Manager or a Nurse Unit Manager (Bull & Hart, 2008; Elsom, Happnell & Manias, 2006). In New Zealand the role is defined as a senior clinical nursing role which includes clinical expertise, research, auditing and evidence based practice (N Z Nurse, 2008).

Table 5.1

Gender, Age and Professional Designation of 104 Participants

Variable	n	%
Gender +		
Female	92	88.5
Male	11	10.6
Age *		
20-25	1	1.0
26-30	10	9.6
31-35	16	15.4
36-40	23	22.1
41-45	26	25.0
46-50	14	13.5
>50	12	11.5
Designation		
RN	40	38.5
CN	19	18.3
CNS	37	35.6
Other	8	7.7

* Missing data (n=2)

+ Missing data (n=1)

5.2.3 Employment and nursing qualifications of participants (Table 5.2).

Over 70% (n=76) of participants had previous experience in another critical care area including neonatal intensive care (n=21, 20.2%), adult intensive care (n=49, 47.1%), adult coronary care (n=1, 1.0%) or all three critical care areas (n=5, 4.8%).

Eighty nine (85.5%) participants had more than five years experience working in PIC, with 36 (34.6%) participants having 6-10 years experience. Fifty (48.0%) participants had a postgraduate qualification in paediatric intensive care. Forty five (43.0%) participants had a postgraduate qualification in adult intensive care as well as five or more years working with paediatric intensive care patients. Six (5.8%) participants had no postgraduate paediatric intensive care qualification but did meet the selection criteria of the “experienced paediatric intensive care nurse”. Three (2.9%) participants had a neonatal intensive care postgraduate qualification. Overall, the participants represented the required target group, supplemented by the transport group, with suitable clinical experience relevant to the area of study. These 104 participants could be considered to be a significant cross section of nurses with relevant experience in endotracheal suction in the paediatric intensive care environment in Australia and New Zealand.

Table 5.2

Employment and Nursing Qualifications Data of 104 Participants

Variable	n	%
Number of years working in PICU *		
1-5	12	11.5
6-10	36	34.6
11-15	23	22.1
>15	30	28.8
Area of experience		
None	28	26.9
Neonatal Intensive Care	21	20.2
Adult Intensive Care	49	47.1
Adult Coronary Care	1	1.0
Combined areas	5	4.8
Postgraduate qualification		
Neonatal Intensive Care	3	2.9
Paediatric Intensive Care	50	48.1
Adult Intensive Care	45	43.3
None	6	5.8
Name of Hospital		
Australian tertiary based hospitals	48	46.1
Starship - New Zealand	18	17.4
Emergency and retrieval services in Australia	38	36.5

* Missing data (n=3)

5.3 Clinical Criteria Used to Determine When to Perform Endotracheal Tube Suction and their Rating (tables 5.3, 5.4)

To determine the essential criteria to be included in the design of an Endotracheal Suction Assessment Tool (ESAT) it was important to assess the criteria identified within the literature determining the requirement for endotracheal suction (ETT) within the clinical setting by obtaining suitable input from experienced nurses. Participants were asked 30 quantitative questions within the Endotracheal Suction Questionnaire directly relating to the requirement for ETT suction. Fifteen questions asked how often each specific criterion was used when determining whether ETT suction was required and 15 questions asked participants to rate the importance of the same criterion when deciding whether to perform ETT suction. These criteria were identified from the literature review and included two additional criteria suggested by the reviewers.

5.3.1 Frequency of Use of Criteria.

Two criteria had calculated means greater than 90 and were strongly supported by the participants as the most often used criteria. These were “suspected obstruction of the endotracheal tube by secretions” (M=91.7mm, SD=11.2, Mdn=97.0mm) and “visible or audible secretions” (M=91.0mm, SD=8.6, Mdn=93.0mm). Two criteria had calculated means below 60 indicating a low significance to the respondents of the questionnaire. These were “Haemodynamics (unexplained changes in heart rate/BP & ICP if applicable)” (M=53.3mm, SD=23.4, Mdn=52.0mm) and “Frequency of endotracheal tube suction is set by unit protocol/guidelines” (M=39.3mm, SD=33.6, Mdn=29.0mm). The other 11 criteria ranged in value from M=86.4mm, SD=10.8, Mdn=88.5mm to M=64.4mm, SD=21.7, Mdn=66.5mm (Table 5.3).

Table 5.3

Mean, Standard Deviation and Median Results for How Often a Specific Clinical Criterion was Used when Determining Whether to Perform Endotracheal Suction

Criteria	<i>M</i> (SD)	<i>Mdn</i>
Suspected obstruction of the endotracheal tube by secretions	91.7 (11.2)	97.0
Visible or audible secretions	91.0 (8.6)	93.0
Decreased oxygen saturation/cyanosis	86.4 (10.8)	88.5
Suspected aspiration	82.2 (18.7)	88.0
Dyspnoea or signs of respiratory distress	79.6 (15.3)	83.0
Coughing	76.4 (17.3)	78.5
Decreased tidal volume delivery	75.8 (19.4)	83.0
Increased peak pressure	75.2 (20.6)	81.0
Auscultation (altered, diminished, abnormal air entry)	70.6 (21.7)	75.5
Increasing end tidal CO ₂	69.3 (24.6)	76.5
Altered chest movement	68.5 (22.2)	71.5
Unexplained patient restlessness	65.2 (22.0)	71.0
Alteration in arterial blood gas results	64.4 (21.7)	66.5
Haemodynamics (unexplained changes in heart rate/BP & ICP if applicable)	53.3 (23.4)	52.0
Frequency of endotracheal tube suction is set by unit protocol/guidelines	39.3 (33.6)	29.0

5.3.2 Importance of Criteria.

Two criteria had calculated means greater than 90 and “stood out” as the highest rating criteria for importance. These were “suspected obstruction of the endotracheal tube by secretions” (M=92.4mm, SD=9.7, Mdn=86.0mm) and “visible or audible secretions” (M=89.1mm, SD=11.4, Mdn=93.0mm). Two criteria had calculated means below 60 indicating a low significance to the respondents of the questionnaire. These were “haemodynamics (unexplained changes in heart rate/BP & ICP if applicable)” (M=62.9mm, SD=22.3, Mdn=66.0mm) and “frequency of endotracheal tube suction is set by unit protocol/guidelines” (M=41.3mm, SD=32.9, Mdn=39.0mm). The other 11 criteria ranged in value from M=89.1mm, SD=11.4, Mdn=93.0mm to M=67.2mm, SD=20.4, Mdn=72.0mm (Table 5.4).

Table 5.4

Mean, Standard Deviation and Median for the Importance of Clinical Criteria in Determining Whether to Perform Endotracheal Suction

Criteria	<i>M</i> (SD)	<i>Mdn</i>
Suspected obstruction of the endotracheal tube by secretions	92.4 (9.7)	86.0
Visible or audible secretions	89.1 (11.4)	93.0
Decreased oxygen saturation/cyanosis	86.6 (10.8)	89.0
Suspected aspiration	83.8 (17.9)	90.0
Dyspnoea or signs of respiratory distress	82.9 (15.8)	88.0
Increased peak pressure	79.1 (18.5)	85.0
Decreased tidal volume delivery	78.7 (18.9)	85.0
Auscultation (altered, diminished, abnormal air entry)	78.0 (19.7)	83.0
Coughing	75.9 (18.4)	82.0
Increasing end tidal CO ₂	74.6 (21.7)	82.0
Alteration in arterial blood gas results	73.6 (19.0)	78.0
Altered chest movement	73.0 (20.9)	78.0
Unexplained patient restlessness	67.2 (20.4)	72.0
Haemodynamics (unexplained changes in heart rate, BP and/or ICP)	62.9 (22.3)	66.0
Frequency of endotracheal tube suction is set by unit protocol/guidelines	41.3 (32.9)	39.0

5.4 Relationship Testing between How Often a Criterion was Used in Endotracheal Tube Suction and its Rating of Importance

The following section describes the calculation of the relationship between how often a specific criterion was used when determining if endotracheal suction was required and the perceived rating of importance of each criterion by the participants. Spearman rank order correlation coefficient (r_s) was used to test the relationship between how often the 15 criteria were used in determining the need for endotracheal tube (ETT) suction and the rating of importance of each criterion when determining whether to perform ETT suction after collating the participants' responses. The values used were $Rho = 0.10$ to 0.29 or -0.10 to -0.29 : indicating a small correlation, $Rho = 0.30$ to 0.49 or -0.30 to -0.49 : indicating a moderate correlation and $Rho = 0.50$ to 1.0 or -0.50 to -1.0 : indicating a strong correlation (Pallant, 2005). For clarity, scatter plots are provided to present a visual representation of the correlation between how often a specific criterion was used for the initiation of endotracheal suction and the ranking of that specific criterion (Figures 6-20).

Preliminary analyses were performed to ensure no violation of the assumptions of normality, linearity and homoscedasticity occurred. Normality was checked by plotting histograms from the scores for each variable and calculating the significance values for each variable using Kolmogorov-Smirnov statistics. The p value scores for both variables, how often the variable was used as an indicator for the requirement to perform suction and the importance rating of each variable, indicates a non-significant result for each variable which shows normality in the distribution of the scores.

5.4.1 Scatter Plots Illustrating the Relationship between How Often a Criterion was Used and its Rating of Importance.

Spearman rank order coefficient analysis is described and shown in table format (Table 5.5). Graphical representation of the linear relationship between the two variables of how often a variable was used in determining the requirement for endotracheal tube suction and the importance rating of each variable are illustrated by scatter plots (Figures 6-20). The scatter plots showed there was evidence of homoscedasticity (constant variance) in the variability of r_s scores.

Table 5.5

Spearman Rank Order Correlation Coefficients and P Values for the Relationship between How Often the 15 Variables are Used and the Rating of Each Criterion

Criteria	r_s	p
Unexplained patient restlessness	0.78	$p<0.001$
Increased end tidal CO ₂	0.74	$p<0.001$
Alteration in arterial blood gas results	0.72	$p<0.001$
Frequency of endotracheal tube secretion is set by unit protocol/guidelines	0.71	$p<0.001$
Suspected aspiration	0.70	$p<0.001$
Decreased tidal volume delivery	0.69	$p<0.001$
Increased peak pressure	0.68	$p<0.001$
Suspected obstruction of the endotracheal tube by secretions	0.65	$p<0.001$
Altered chest movement	0.64	$p<0.001$
Haemodynamics (unexplained changes in heart rate, BP and/or ICP)	0.62	$p<0.001$
Coughing	0.57	$p<0.001$
Auscultation (altered, diminished, abnormal air entry)	0.56	$p<0.001$
Dyspnoea or signs of respiratory distress	0.53	$p<0.001$
Decreased oxygen saturations/cyanosis	0.51	$p<0.001$
Visible or audible secretions	0.42	$p<0.001$

There was a strong, significant, positive correlation between “unexplained patient restlessness” as a specific criterion for performing endotracheal suction and the rating of its importance when performing ETT suction ($r_s = 0.78$, $n = 104$, $p < 0.001$) (Table 5.5). There was also a positive relationship between how often “unexplained patient restlessness” is used as a criterion when determining if endotracheal suction is required and the rating of its importance when determining whether to perform suction (Figure 6).

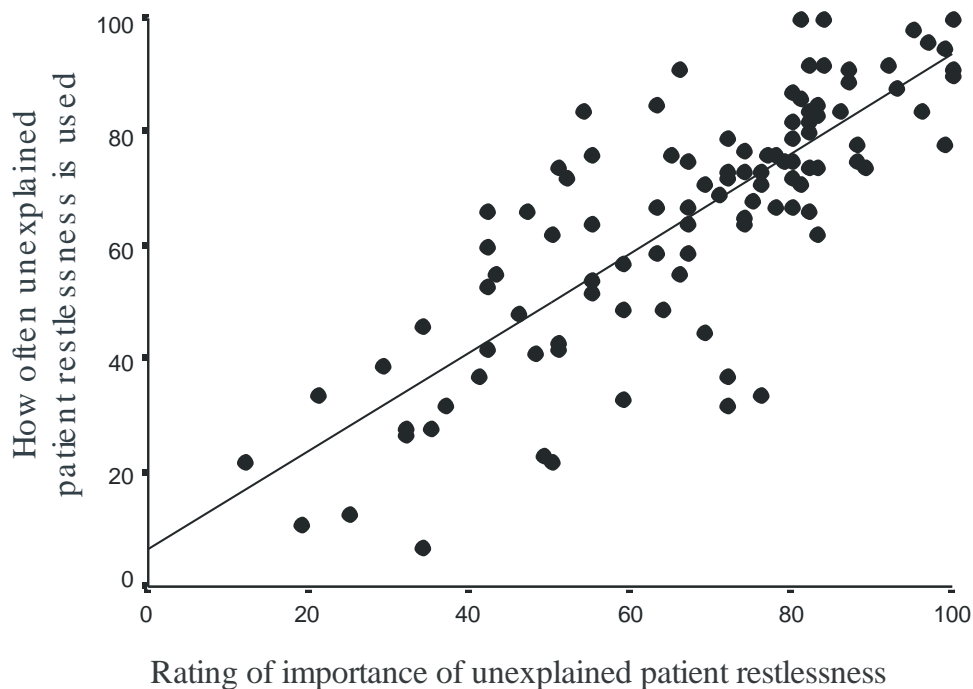


Figure 6. Scatter plot correlation between how often unexplained patient restlessness was used as a determining criteria for endotracheal suction and the rating of importance when determining endotracheal suction.

There was a strong, significant, positive correlation between “increased end tidal carbon dioxide” as a specific criterion for performing endotracheal suction and the rating of its importance when performing ETT suction ($r_s = 0.74$, $n = 104$, $p < 0.001$) (Table 5.5). There was also a positive relationship between how often “increasing end tidal carbon dioxide” is used as a criterion when determining if endotracheal suction is required and its rating of importance when determining whether to perform suction (Figure 7).

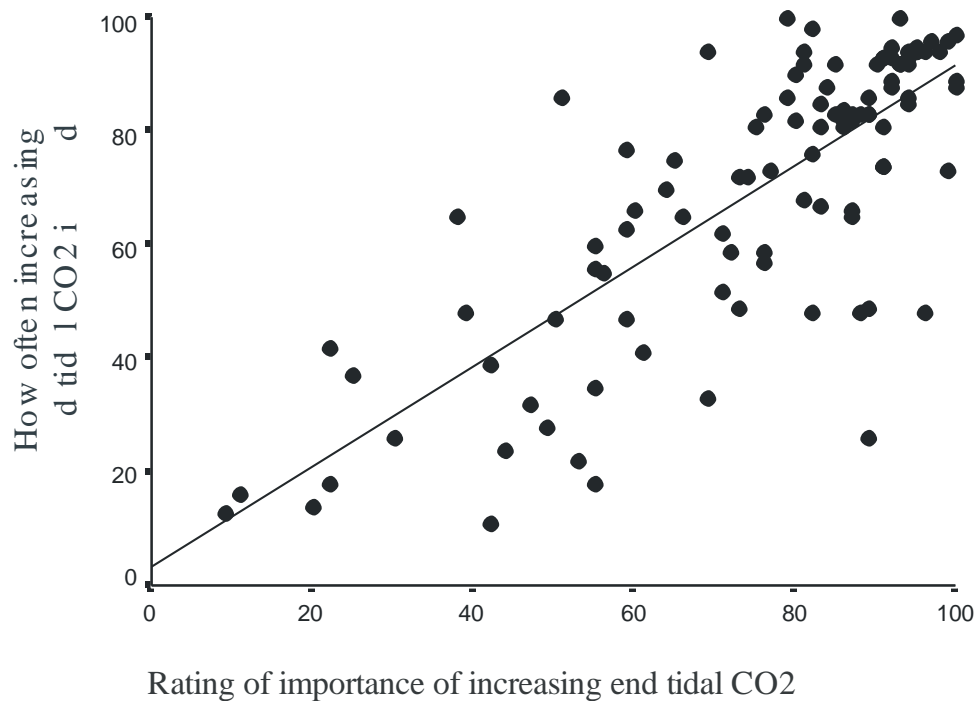


Figure 7. Scatter plot correlation between how often increasing end tidal CO₂ was used as a determining criteria for endotracheal suction and the rating of importance when determining endotracheal suction.

There was a strong, significant, positive correlation between “alteration in arterial blood gas results” as a specific criterion for performing endotracheal suction and its rating of importance when performing ETT suction ($r_s = 0.72$, $n = 104$, $p < 0.001$) (Table 5.5). There was also a positive relationship between how often “alterations in blood gas results” is used as a criterion when determining if endotracheal suction is required and its rating of the importance when determining whether to perform suction (Figure 8).

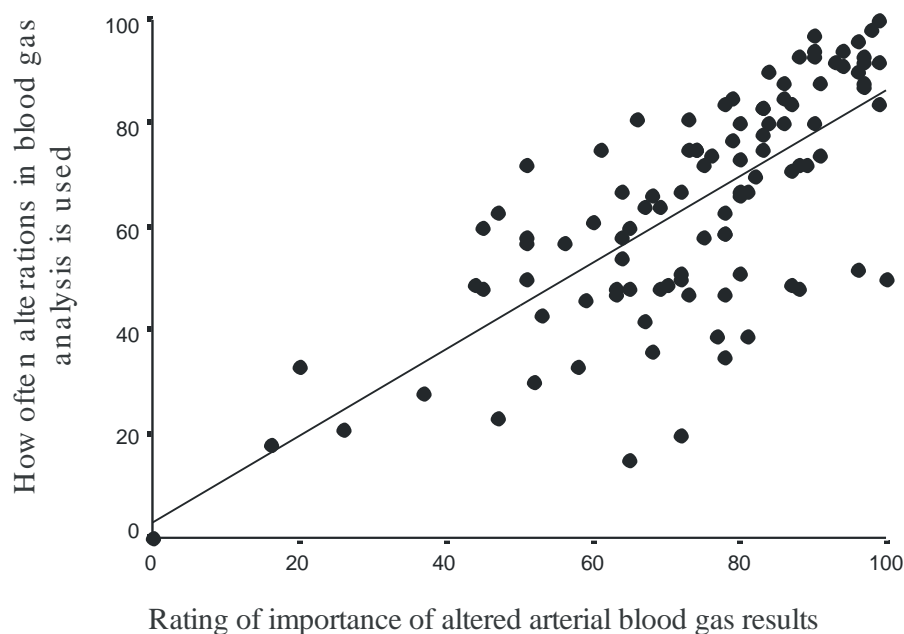


Figure 8. Scatter plot correlation between how alteration in arterial blood gas results was used as a determining criterion for endotracheal suction and the rating of importance when determining endotracheal suction.

There was a strong, significant, positive correlation between the frequency of endotracheal tube suction is set by “unit protocol/guidelines” as a specific criterion for performing endotracheal suction and its rating of importance when performing ETT suction ($r_s = 0.71$, $n = 104$, $p < 0.001$) (Table 5.5). There was also a positive relationship between how often “unit protocol or guidelines” is used as a criterion when determining if endotracheal suction is required and its rating of importance when determining whether to perform suction (Figure 9).

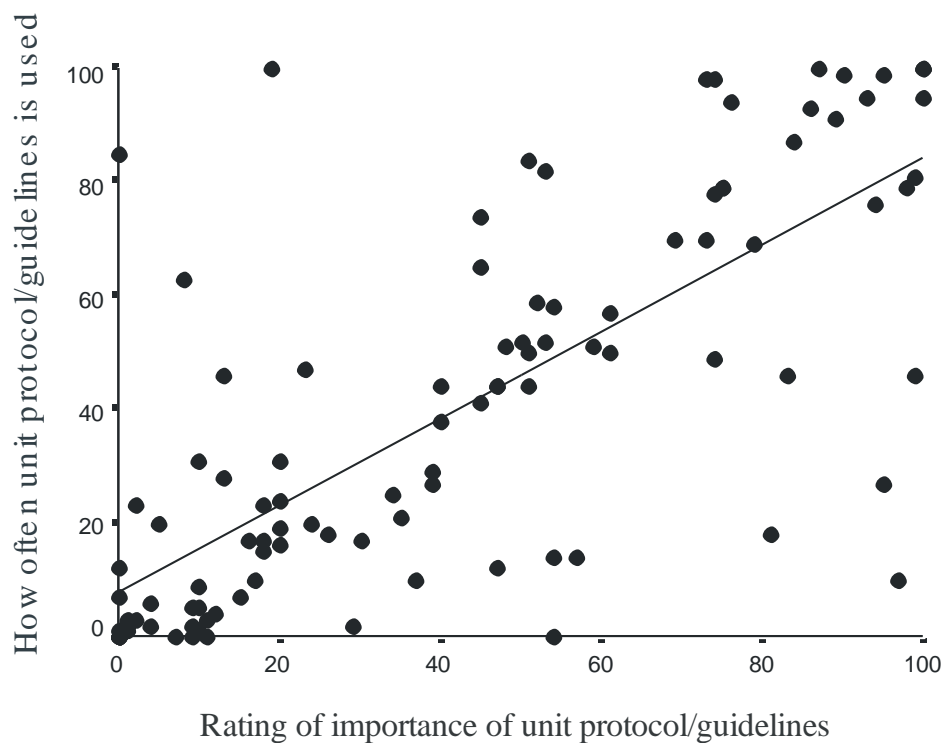


Figure 9. Scatter plot correlation between how often frequency of endotracheal suction is set by unit protocol/guidelines was used as a determining criteria for endotracheal suction and the rating of importance when determining endotracheal suction.

There was a strong, significant, positive correlation between “suspected aspiration” as a specific criterion for performing suction and its rating of importance when performing ETT suction ($r_s = 0.70$, $n = 104$, $p < 0.001$) (Table 5.5). There was also a positive relationship between how often “suspected aspiration” is used as a criterion when determining if endotracheal suction is required and its rating of importance when determining whether to perform suction (Figure 10).

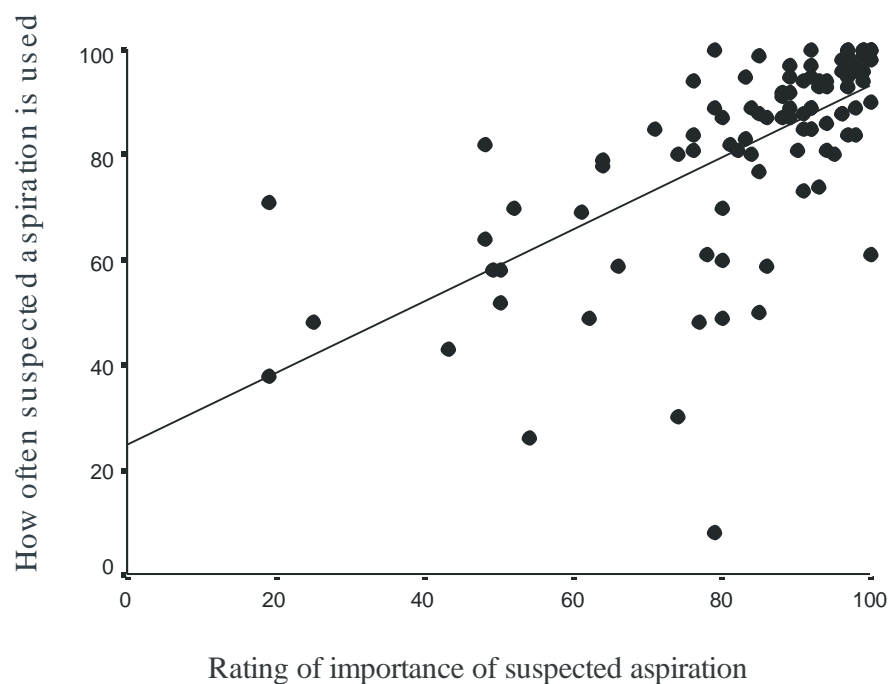


Figure 10. Scatter plot correlation between how often suspected aspiration was used as a determining criterion for endotracheal suction and the rating of importance when determining endotracheal suction.

There was a strong, significant, positive correlation between “decreased tidal volumes delivery” as a specific criterion for performing endotracheal suction and its rating of importance when performing ETT suction ($r_s = 0.69$, $n = 104$, $p < 0.001$) (Table 5.5). There was also a positive relationship between how often “decreased tidal volume delivery” is used as a criterion when determining if endotracheal suction is required and its rating of the importance when determining whether to perform suction (Figure 11).

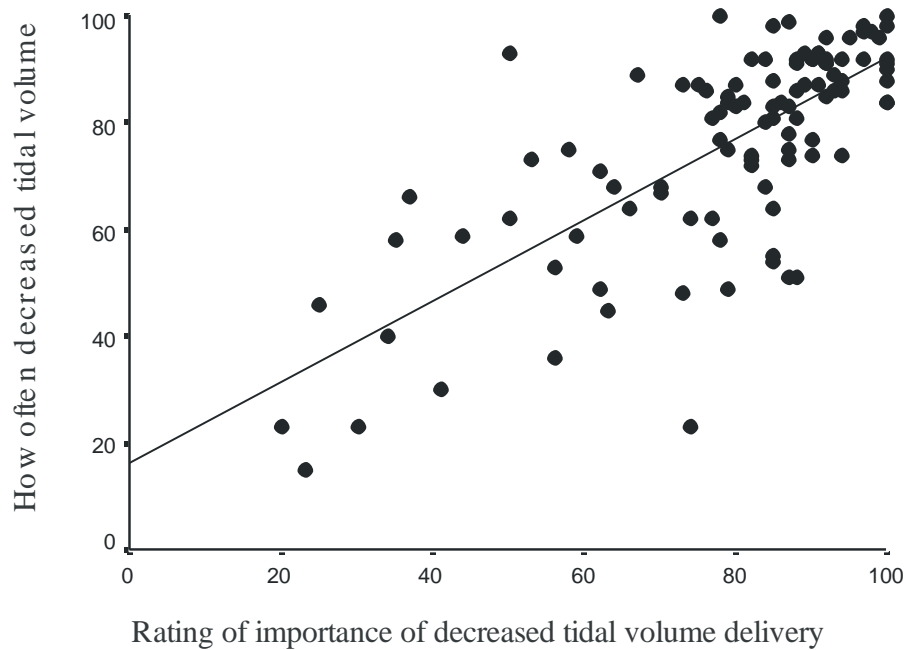


Figure 11. Scatter plot correlation between how often decreased tidal volume delivery was used as a determining criterion for endotracheal suction and the rating of importance when determining endotracheal suction.

There was a strong, significant, positive correlation between “increased peak pressure” as a specific criterion for performing endotracheal suction and the rating of its importance when performing ETT suction ($r_s = 0.68$, $n = 104$, $p < 0.001$) (Table 5.5). There was also a positive relationship between how often “increased peak pressure” is used as a criterion when determining if endotracheal suction is required and its rating of importance when determining whether to perform suction (Figure 12).

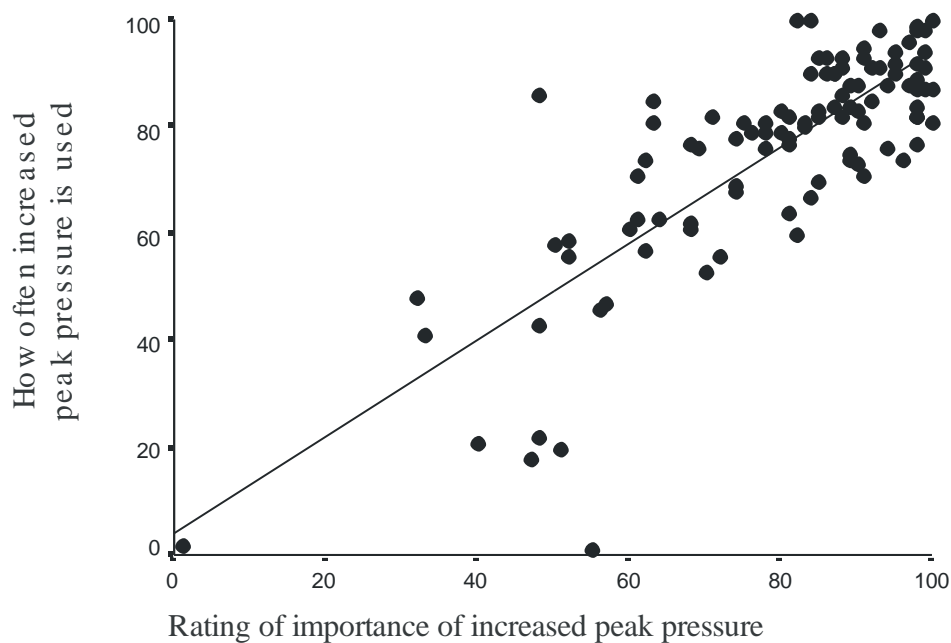
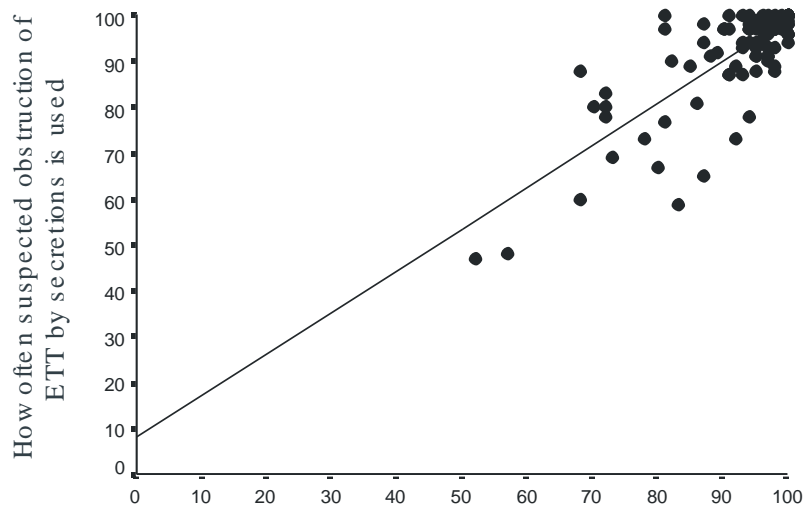


Figure 12. Scatter plot correlation between how often increased peak pressure was used as a determining criterion for endotracheal suction and the rating of importance when determining endotracheal suction.

There was a strong, significant, positive correlation between “suspected obstruction of the endotracheal tube (ETT) by secretions” as a specific criterion for performing suction and its rating of importance when performing ETT suction ($r_s = 0.65$, $n = 104$, $p < 0.001$) (Table 5.5). There was also a positive relationship between how often “suspected obstruction of the endotracheal tube by secretions” is used as a criterion when determining if endotracheal suction is required and its rating of importance when determining whether to perform suction (Figure 13).



Rating of importance of suspected obstruction of ETT by secretions

Figure 13. Scatter plot correlation between how often suspected obstruction of the endotracheal tube by secretions was used as a determining criterion for endotracheal suction and the rating of importance when determining endotracheal suction.

There was a strong, significant, positive correlation between “altered chest movement” as a specific criterion for performing endotracheal suction and its rating of importance when performing ETT suction ($r_s = 0.64$, $n = 104$, $p < 0.001$) (Table 5.5). There was also a positive relationship between how often “altered chest movement” is used as a criterion when determining if endotracheal suction is required and its rating of the importance when determining whether to perform suction (Figure 14).

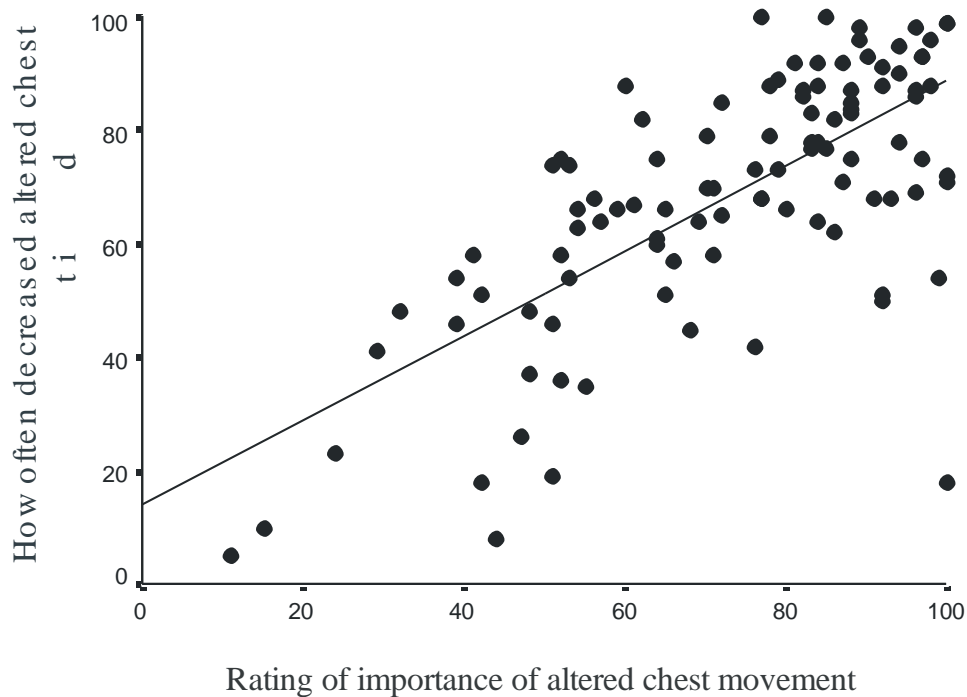


Figure 14. Scatter plot correlation between how often altered chest movement was used as a determining criterion for endotracheal suction and the rating of importance when determining endotracheal suction.

There was a strong, significant, positive correlation between “haemodynamics (unexplained changes in heart rate, BP and/or ICP)” as a specific criterion for performing endotracheal suction and its rating of importance of when performing ETT suction ($r_s = 0.62$, $n = 104$, $p < 0.001$) (Table 5.5). There was also a positive relationship between how often “haemodynamics (unexplained changes in heart rate/BP & ICP if applicable)” is used as a criterion when determining if endotracheal suction is required and its rating of importance of when determining whether to perform suction (Figure 15).

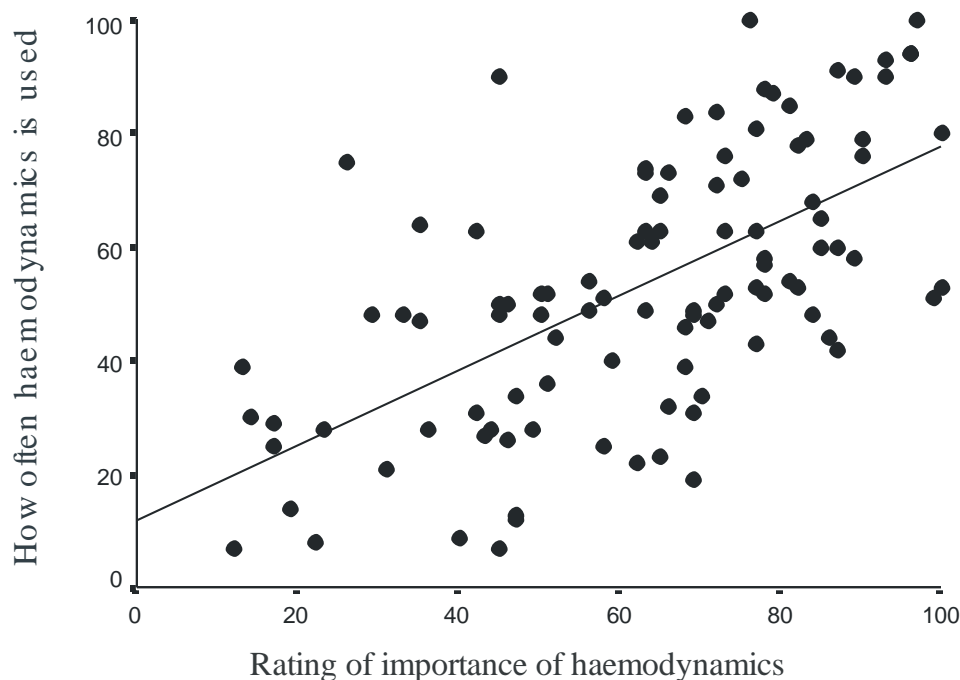


Figure 15. Scatter plot correlation between how often haemodynamics (unexplained changes in heart rate/BP & ICP if applicable) was used as a determining criteria for endotracheal suction and the rating of importance when determining endotracheal suction.

There was a strong, significant, positive correlation between “coughing” as a specific criterion for performing endotracheal suction and its rating of importance when performing ETT suction ($r_s = 0.57$, $n = 104$, $p < 0.001$) (Table 5.5). There was also a positive relationship between how often “coughing” is used as a criterion when determining if endotracheal suction is required and its rating of importance when determining whether to perform suction (Figure 16).

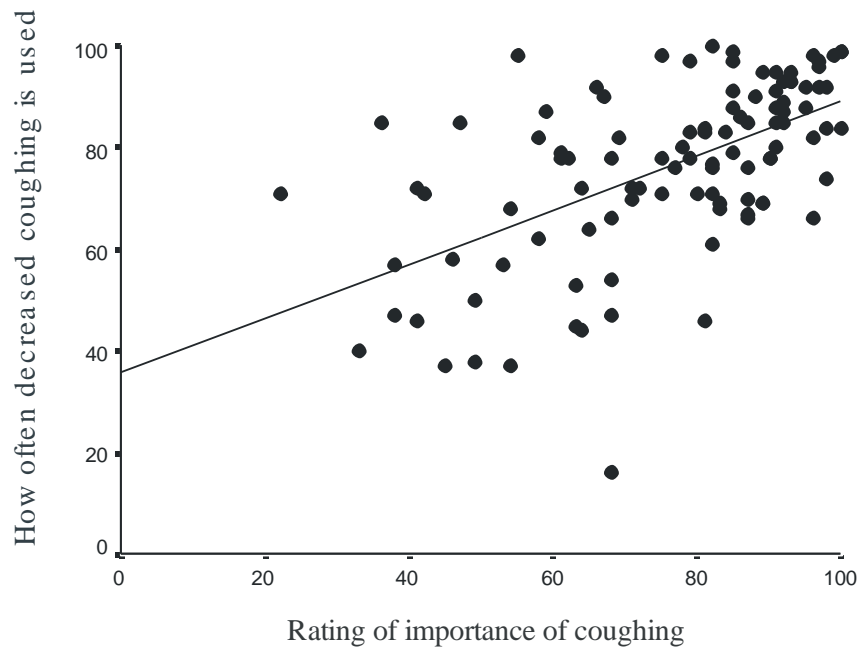


Figure 16. Scatter plot correlation between how often coughing was used as a determining criteria for endotracheal suction and the rating of importance when determining endotracheal suction.

There was a strong, significant, positive correlation between “auscultation” as a specific criterion for performing endotracheal suction and its rating of importance when performing ETT suction ($r_s = 0.56$, $n = 104$, $p < 0.001$) (Table 5.5). There was also a positive relationship between how often “auscultation (altered, diminished, abnormal air entry)” is used as a criterion when determining if endotracheal suction is required and its rating of importance when determining whether to perform suction (Figure 17).

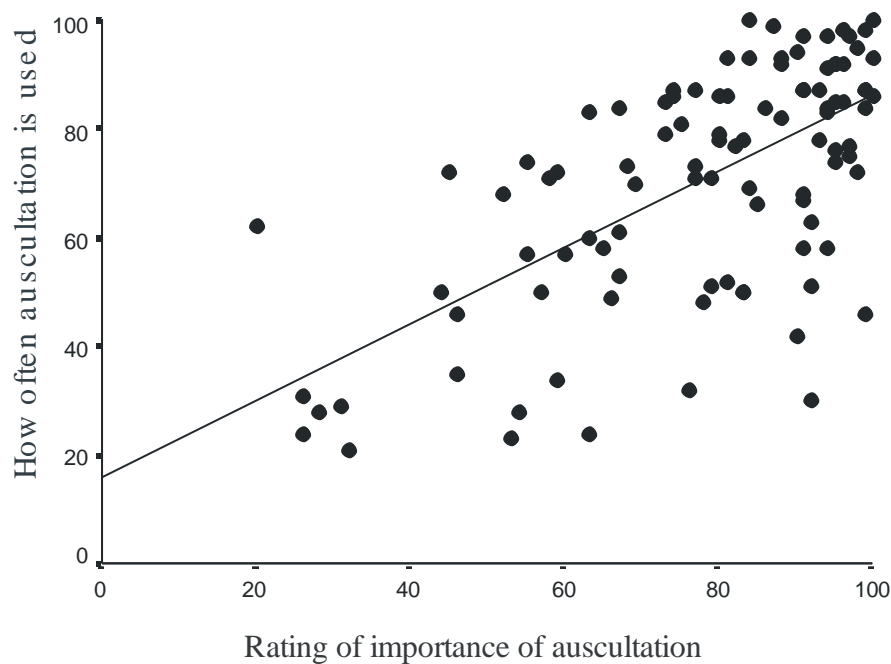


Figure 17. Scatter plot correlation between how often auscultation (altered, diminished, abnormal air entry) was used as a determining criteria for endotracheal suction and the rating of importance when determining endotracheal suction.

There was a strong, significant, positive correlation between “dyspnoea or signs of respiratory distress” as a specific criterion for performing endotracheal suction and its rating of importance when performing ETT suction ($r_s = 0.53$, $n = 104$, $p < 0.001$) (Table 5.5). There was also a positive relationship between how often “dyspnoea” is used as a criterion when determining if endotracheal suction is required and its rating of importance when determining whether to perform suction (Figure 18).

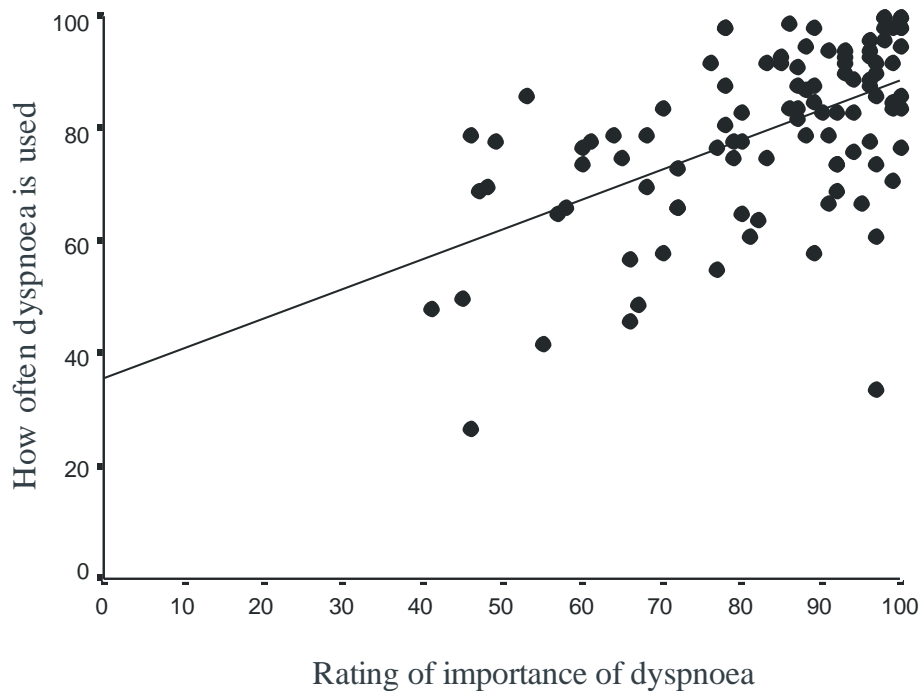


Figure 18 Scatter plot correlation between how often dyspnoea was used as a determining criteria for endotracheal suction and the rating of importance when determining endotracheal suction.

There was a strong, significant, positive correlation between “decreased oxygen saturations/cyanosis” as a specific criterion for performing endotracheal suction and its rating of importance when performing ETT suction ($r_s = 0.51$, $n = 104$, $p < 0.001$) (Table 5.5). There was also a positive relationship between how often “decrease oxygen saturations or cyanosis” is used as a criterion when determining if endotracheal suction is required and its rating of importance when determining whether to perform suction (Figure 19).

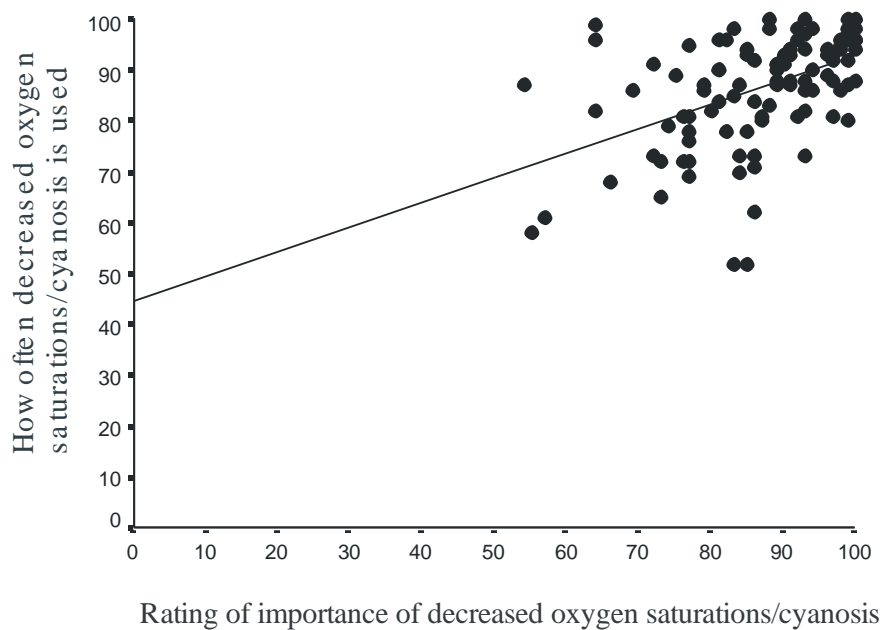


Figure 19. Scatter plot correlation between how often decreased oxygen saturations/cyanosis was used as a determining criterion for endotracheal suction and the rating of importance when determining endotracheal suction.

There was a moderate, significant, positive correlation between “visible or audible secretions” as a specific criterion for performing endotracheal suction and its rating of importance when performing ETT suction ($r_s = 0.42$, $n = 104$, $p < 0.001$) (Table 5.5). There was also a positive relationship between how often “visible or audible secretions” is used as a criterion when determining if endotracheal suction is required and its rating of importance when determining whether to perform suction (Figure 20).

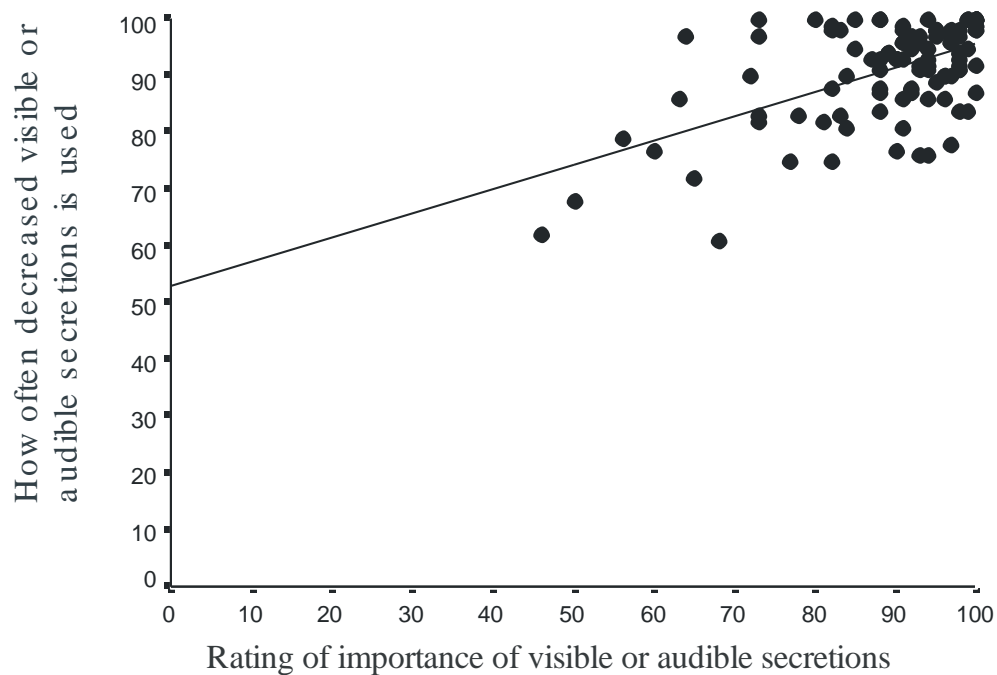


Figure 20. Scatter plot correlation between how often visible or audible secretions was used as a determining criteria for endotracheal suction and the rating of importance when determining endotracheal suction.

In summary, all but two of the 36 questions in the ESQ (Appendix 10) achieved the preset criteria of 83% for clarity, four others were adjusted in accordance with suggestions from the reviewers after due consideration of their appropriateness and two new criteria were added. The ESQ was modified by deleting question seven as it was deemed ambiguous and redundant. The examples for questions nine and ten were changed to appropriately reflect the clinical setting. “Queried aspiration” was changed to “suspected aspiration” to achieve an improved clarity in the terminology used. Question 11b was adjusted to improve the clarity of the question. Two additional criteria: “suspected obstruction of the endotracheal tube by secretions” and “frequency of endotracheal tube suction is set by unit protocol/guidelines” were added to the ESQ as they were considered relevant to the study and covered criteria not previously included (Appendix 17).

A total of 22% (n=48) of potential participants from the Australian target population returned the ESQ; whereas 51% (n=18) were returned by potential participants from the New Zealand target population. Most participants were aged between 36 and 45 years, with varied clinical experience where the majority had a postgraduate certificate in intensive care nursing (98%, n=98). The participants represented the required target group, supplemented by the transport group (n=38), with suitable clinical experience relevant to the area of study. The 104 participants could be considered as a significant cross section of nurses with relevant experience in endotracheal suction in the paediatric intensive care environment in Australia and New Zealand.

There were two criteria which statistically “stood out” as the most often used criteria. These were “suspected obstruction of the endotracheal tube by secretions” (M=91.7mm, SD=11.2, Mdn=97.0mm) and “visible or audible secretions” (M=91.0mm, SD=8.6, Mdn=93.0mm) (Table 5.3). These two criteria also received the highest rating for importance with “suspected obstruction of the endotracheal tube by secretions” (M=92.4mm, SD=9.7, Mdn=86.0mm) and “visible or audible secretions” (M=89.1mm, SD=11.4, Mdn=93.0mm) (Table 5.4).

There were two criteria which were statistically rated of low significance by the respondents of the questionnaire. These were “haemodynamics (unexplained changes in heart rate/BP & ICP if applicable)” (M=53.3mm, SD=23.4, Mdn=52.0mm) and “frequency of endotracheal tube suction is set by unit protocol/guidelines”

(M=39.3mm, SD=33.6, Mdn=29.0mm) (Table 5.3). There two criteria were also rated of lower significance by the respondents of the questionnaire, “haemodynamics (unexplained changes in heart rate/BP & ICP if applicable)” (M=62.9mm, SD=22.3, Mdn=66.0mm) and “frequency of endotracheal tube suction is set by unit protocol/guidelines” (M=41.3mm, SD=32.9, Mdn=39.0mm) (Table 5.4).

Preliminary analyses calculated the significance values for each variable using Kolmogorov-Smirnov statistics and scatter plot analysis. These calculations determined the linear relationship between how often a criterion was used, and the importance rating of that criterion in the process of determining if endotracheal tube suction was warranted. This ensured no violation of the assumptions of normality, linearity and homoscedasticity occurred. Scatter plot analysis of the relationship between the criteria used in performing endotracheal suction and the ranking of the criterion showed a positive relationship (high scores on one variable are associated with high scores on the other). Spearman rank order correlation coefficient analyses showed a positive correlation between the perceived frequency of use of a criterion and the appropriateness of the assessment. If the criterion rated high as an indicator for initiating endotracheal suction it also rated high in the rankings. If the criterion was used less frequently as a clinical indicator for the requirement for endotracheal suction then participants had a lower regard for this when rating the criterion as a specific single indicator to perform suction. Critical analysis and discussion of these results will follow in Chapter 6.

5.5 Qualitative Data

There were 19 codes (Table 5.6) identified from within the written accounts by the participants of an endotracheal suction procedure. The data from each of the qualitative questions was analysed using content analysis principles (LoBiondo-Wood & Harper, 2006; Speziale & Carpenter, 2007). The first step in this process was to revisit the questions being asked and to reconfirm the purpose of the study. Initially, the study aimed to link the criteria identified within the literature to current clinical practice. Equally important was to identify any other criteria that had practical application in the clinical setting that could be incorporated in the development of an endotracheal suction assessment tool (Phase 4). Through comparison of the codes identified within the written accounts with the codes identified from a review of the literature, four previously unidentified codes were found. These were: “history”, “combination of factors”, “treatments directly relating to airway manipulation” and “transport related”. When participants described other criteria they would consider using when determining whether to proceed with endotracheal suction, 13 codes were identified (Table 5.8).

5.5.1 Criteria (codes) identified from participants’ descriptions of an endotracheal suction procedure.

The first open ended question was “Describe as fully as possible a recent ETT suction experience you performed. Include in your description the specific factors that influenced your decision to perform endotracheal suction for this patient.” The participant’s responses were read carefully by the researcher to identify the criteria (codes or key words) in the transcripts that directly influenced participants’ decisions about whether to perform endotracheal tube suction. These codes were then systematically counted and recorded. A total of 19 codes were identified (Table 5.6).

Table 5.6

Criteria (codes) Identified from Participant Descriptions of an Endotracheal Suction Procedure that Influenced the Decision of Whether to Perform the Procedure (n=19)

Code	n
Oxygen saturation readings	46
Secretions	40
Coughing	38
Ventilation parameters	31
Respiratory assessment	27
Clinical indicators	20
Clinical condition	19
History	18
Respiratory distress	18
Patient activity	15
Combination of factors	10
Diagnostic tests	10
Clinical treatments	8
Carbon dioxide readings	7
Arterial blood gas analysis	6
Transport of patient	5
Post repositioning	4
Patency of endotracheal tube	3
Patient skin colour	2

These codes were then compared with the codes previously identified within the literature in Phase One (Chapter 2). The codes previously identified within the literature were identified within the participant's transcripts:

- Respiratory distress
- Respiratory assessment
- Secretions
- Coughing
- Patient activity
- Carbon dioxide readings
- Diagnostic testing
- Arterial blood gas analysis
- Clinical condition
- Clinical indicators
- Patient skin colour
- Oxygen saturation readings
- Protocol or routine requirement
- Ventilation parameters
- Patency of endotracheal tube

The transcripts were then re-read to identify criteria/codes that had not previously been identified within the literature. The new codes included “patient history”, for example “frequency of suction over last 24-48 hours,” “combination of factors”, for example “decreasing tidal volume with increasing peak pressure, rising end tidal carbon dioxide with audible secretions on auscultation”, “treatments directly relating to airway manipulation”, for example “suctioning of the ETT prior to bronchoscopic examination of the airway” and “transport related” for example “as part of preparation for transport endotracheal suction performed”. These codes were then systematically counted and recorded (Table 5.7).

Table 5.7

Newly Identified Codes (Criteria Influencing Participants’ Decision to Perform Endotracheal Suction) (n=4)

Code	n
Patient history	18
Combination of factors	10
Treatments directly relating to airway manipulation	8
Transport related	5

5.5.2 Criteria (codes) identified from participant descriptions of what criteria they personally consider to determine endotracheal suction is required.

The second qualitative question asked “What criteria (other than those you have described above) do you personally consider when determining if a child requires endotracheal suction?” The transcripts of responses to this question were read to identify criteria/codes that the participants considered outside their previous written accounts of an endotracheal suction procedure. Thirteen new codes were identified, systematically recorded and counted. The new criteria were: “history of patient condition”, “previous tolerance to procedure”, “type of secretions during last suction”, “combination of clinical indicators”, “diagnosis”, “type of artificial ventilation”, “post-repositioning”, “available staff to assist”, “type and size of

endotracheal tube”, “inspiratory/expiratory graph changes”, “transport of patient”, “clinical needs” and “medical order” (Table 5.8).

Table 5.8

Other Criteria (Codes) not Previously Identified by Participants’ that Influenced their Decision to Perform Endotracheal Suction (n=13)

Code	n
History of patient’s condition	42
Previous tolerance to procedure	10
Type of secretions during last shift	10
Combination of clinical indicators	10
Diagnosis	8
Type of artificial ventilation	6
Post repositioning	6
Available staff to assist	4
Type and size of endotracheal tube	3
Inspiratory/expiratory graph changes	3
Transport of patient	3
Clinical needs	3
Medical order	1

In summary, 19 codes (Table 5.6) were identified within the written accounts by the participants of an endotracheal suction procedure. Four previously unidentified codes were found beyond those identified from the literature. These were: “history”, “combination of factors”, “treatments directly relating to airway manipulation” and “transport related”. When participants described other criteria they would consider using when determining whether to proceed with endotracheal suction, 13 codes were identified (Table 5.8). These newly identified codes will be critically analysed and discussed in Chapter 6.

CHAPTER 6

ENDOTRACHEAL SUCTION ASSESSMENT TOOL

The following chapter will present and examine the major findings in this study, and their relationship to methodological, theoretical, practice issues and the Endotracheal Suction Assessment Tool (ESAT) design. The first section of the chapter will discuss findings in terms of their relevance (or not) for inclusion in the development of the ESAT. For clarity, the second section of the chapter will explore briefly the results for Phase One and Phase Two of the study. The third section will discuss the quantitative and qualitative findings from Phase Three supporting the ESAT design. Finally, the study's strengths and limitations will be discussed.

6.1 The Endotracheal Suction Assessment Tool (ESAT) Design (Figure 21)

Endotracheal (ETT) suction is a frequently performed nursing procedure within the Paediatric Intensive Care Unit (PICU). This procedure has the potential to significantly affect the clinical stability of the critically ill child. In the absence of paediatric evidence based clinical guidelines, key physiological indicators that can be obtained from individual patient assessment to support the clinical decision to perform ETT suction have not been clearly defined. The decision to perform ETT suction therefore can only be based largely on previous clinical experience and education, irrespective of the level of skill or expertise of the individual nurse caring for that patient. The potential clinical implications for the patient could be the over or under application of the ETT suction procedure. Prior to this study, there were no paediatric, evidence based tools to assist with decision making and the appropriate assessment of the need to perform this procedure. The decision to undertake this study was prompted by the increasing difficulty of finding adequately qualified staff for the PICU during busy periods. To support and guide nursing practitioners who are new to this specialty area or who only work spasmodically within the PICU, this study was aimed at developing such a tool that was based on empirical evidence. At the completion of the study, findings were used to develop a tool titled the Endotracheal Suction Assessment Tool (ESAT).

The researcher considered the significance of two important factors when planning the study. The first was to establish the common criteria used by experienced paediatric intensive care (PIC) nurses in current practice when assessing the need for endotracheal suction in intubated and ventilated paediatric intensive care patients, within Australia and New Zealand. The second imperative was to determine how experienced PIC nurses rated the importance of each of the identified criteria according to significance and frequency of use when performing ETT suction. These rankings could then be used to identify key criteria for inclusion in the development of a tool to assist inexperienced practitioners.

The ESAT design was based on the results of the quantitative and qualitative data. Therefore, the following section will discuss the reasons for inclusion and exclusion of criteria in the ESAT.

6.1.1 Criterion inclusion.

The results from the quantitative component of the Endotracheal Suction questionnaire (ESQ) showed the five highest ranked specific criteria were similarly ranked for level of importance both in “frequency of use” and “importance when deciding to perform endotracheal suction”. These criteria included in order from highest ranking: “suspected obstruction of the endotracheal tube by secretions”, “visible or audible secretions”, “decreased oxygen saturations/cyanosis”, “suspected aspiration” and “dyspnoea or signs of respiratory distress”.

Variations in the Spearman Rank Order correlation results between how often a criterion was used when determining to perform endotracheal suction and the rating of importance may be due to several factors. As an individual criterion it may rarely stand by itself without another contributing factor supporting the requirement for endotracheal suction; for example, alterations in arterial blood gas results may be due to changes in lung compliance. Appropriate treatment could then require alteration of ventilator parameters rather than the performance of ETT suction (Curley & Moloney, 2001; Hazinski, 1999). It may be the criterion is always highly important as an individual assessment but does not always result in the requirement for ETT suction; for example, auscultation. The moderate correlation of data for “visible or audible secretions” ($r_s = 0.42$, $n = 104$, $p < 0.001$) resulted from the data being clustered in the high range with smaller standard deviation showing less of a linear trend across the

data (Figure 20). This combination of factors shows that a high ranking of importance occurs with less reference to frequency of use.

It is the researcher's opinion that when the qualitative results were examined in conjunction with the quantitative results, it was evident the experienced nurse carefully considers a combination of clinical signs as well as the individual patient's ventilation and oxygen requirements to determine whether to perform ETT suction. Paediatric intensive care nurses observe clinical signs through their assessment of both the respiratory and ventilation status of the patient. Findings suggest that patient assessment focuses first on the patient's respiratory status, then on the patient's ventilation status. These findings were translated to the design of the ESAT, where assessment of the respiratory status of the patient is listed as the first priority, followed by assessment of the ventilation status of the patient (Figure 21).

The qualitative accounts of an endotracheal tube suction procedure suggest the assessment process is complex, where a combination of clinical signs and symptoms are used with no single, determining factor influencing the decision outcome. The complexity of the assessment process suggests the "patient's diagnosis", "clinical history", "previous response to endotracheal suction", "clinical stability", "current mode of artificial ventilation", "preparation for transport" and other factors that influence changes in the patient's "clinical condition" all play a role in the assessment process of the experienced paediatric intensive care nurse. The qualitative results suggest that a complete and thorough assessment of the individual patient need for ETT suction should be based on sound clinical indicators due to the adverse effects of the procedure. The only single criteria that could be excluded from the ESAT design is basing ETT suction on preconceived standardised unit guidelines. These interrelated factors should be assessed by more inexperienced practitioners before considering ETT suction. The ESAT, therefore, has been designed to include a section on "clinical considerations" where factors are listed providing the nurse with all known relevant factors for consideration first.

6.1.2 Criterion exclusion.

When designing the Endotracheal Suction Assessment Tool (ESAT) it was important to design a tool that has practical application within the clinical setting for inexperienced nurses. While “unexplained patient restlessness” and “haemodynamics (e.g. unexplained changes in heart rate, BP and/or ICP)” can be related to the requirement for ETT suction, the potential ambiguity of these clinical signs do not make them specific enough for the target group of nurses for which the ESAT was designed. Furthermore, this was confirmed by the infrequency and low rating of these clinical signs by study participants for determining whether ETT suction was warranted. As previously discussed, the frequency of endotracheal tube suction as set by “unit protocols or guidelines” was also not supported by experienced nurses (study participants) as a reason for endotracheal tube suction and, therefore, was not included in the ESAT design.

6.2 The Endotracheal Suction Assessment Tool (ESAT)

The ESAT design has been based on the results of the quantitative and qualitative data as shown in Figure 21.

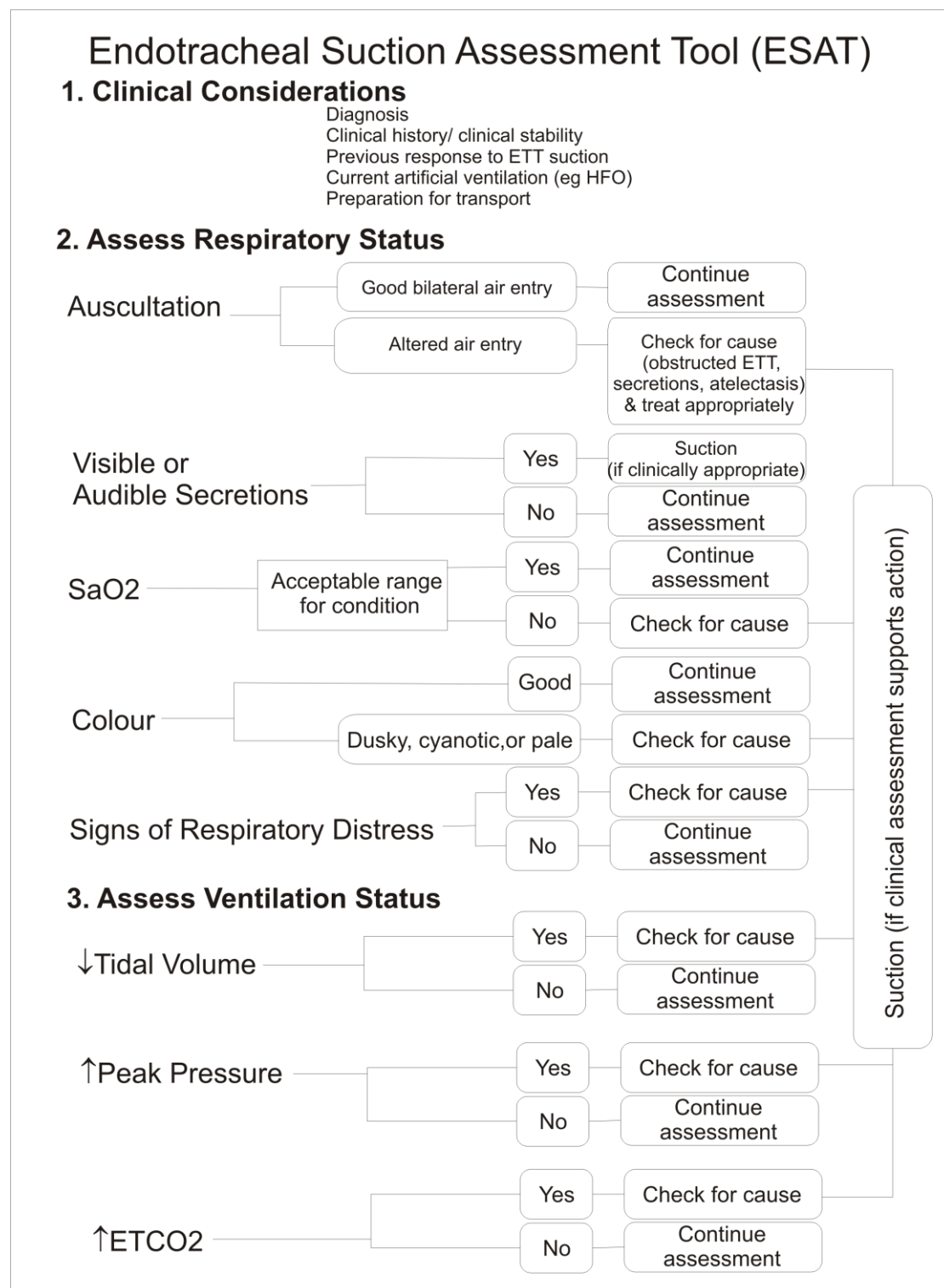


Figure 21. Endotracheal Suction Assessment Tool.

6.3 Phase One and 2 Results

Phase One of the study involved undertaking a comprehensive review of the literature to establish the most common criteria associated with performing endotracheal suction, and development of an Endotracheal Suction Questionnaire (ESQ) that could be used to survey practice by PIC nurses in Australia and New Zealand. The review of published literature established varying levels of evidence (according to NHMRC levels of evidence) in the articles critiqued. Initiation of endotracheal suction was based on a wide range of criteria that could be categorised as either respiratory or haemodynamic clinical indicators. The ESQ was then developed and was based on this evidence. The researcher was mindful of the practicalities of questionnaire design by selecting and summarising the most appropriate criteria for evaluation.

Phase Two of the study involved validating the ESQ (according to content validity, apparent internal consistency and clarity) and making refinements using the validation process established by Aamodt (1983) and Lynn (1986). Apparent internal consistency and content validity testing of the ESQ both achieved the preset 83% agreement between six raters for all items. The clarity rating of the Endotracheal Suction Questionnaire (ESQ) (Appendix 10) achieved the preset criteria of 83% for all but three items (question 7, and exemplars used for questions 9-10). Four reviewers suggested two other criteria should be included. These were: ETT suction was performed due to “suspected obstruction” of the tube, and ETT suction was performed according to unit protocol or guidelines that defined a set time limit between suction procedures. These suggestions by the reviewers were considered by the researcher as valid points despite not achieving the preset 83% agreement, as both had been cited in the literature and were relevant to the research topic. Subsequently these two criteria were included into the questionnaire design.

Based upon these findings, the ESQ was refined by deleting question 7 which was considered redundant, and clarifying the exemplars provided for questions 8-9 to more accurately reflect the clinical setting (Appendix 17).

It is acknowledged that further reliability and validity testing of the revised Endotracheal Assessment Questionnaire (Appendix 17) is required but was not within the remit of this Masters study.

Phase Three of the study involved administration of the ESQ to experienced paediatric intensive care nurses within Australia and New Zealand to validate criteria identified in the literature review, and to identify current practice. The relationship between these results and the Endotracheal Suction Assessment Tool design will now be discussed.

6.4 Summary of Quantitative Results

6.4.1 Demographics.

Inclusion criteria for study participants included five or more years of work experience within a paediatric intensive care unit (PICU) or a postgraduate qualification in paediatric intensive care. The sampling process required submission of the ESQ to a larger target population than the one originally specified to maximise the likelihood of obtaining the most appropriate respondents. On review of the data collated the selection criteria were modified to include those nurses who were also currently involved in the transport and stabilisation of the critically ill child to a tertiary based hospital PICU. This group did not specifically meet the original selection criteria but were considered to be sufficiently qualified and experienced to contribute useful data relevant to the study aim. Their inclusion was deemed important as they were potentially dealing with patients likely to react negatively to the endotracheal tube suction procedure under emergency situations or less than ideal circumstances.

Given the current average age of nurses in Australia is 45 years (Australian Bureau of Statistics, 2005) and in New Zealand is 43 years and increasing (Ministry of Health, 2007), it was not surprising that 97% (n=102) of participants were aged over 25 years of age with a predominance of participants having more than 6 years experience working within the paediatric intensive care (PIC) area. Overall 88% (n= 85) of participants had more than 5 years experience working within the PIC area. Of the 104 participants, 92% (n= 88) were involved in direct patient care with the remaining 8% (n= 16) involved in clinical nursing education at the bedside.

6.4.2 Frequency of use of Respiratory Assessment Criteria.

Participants were asked to mark an 'x' on the line at the point that best reflected how often each of the presented 15 criteria was used to assist with determining if endotracheal suction was required. The line ranged from 0 to 100mm and the mean value, standard deviation and medium were calculated for each criterion.

In analysing the results for how often a specific criterion was used in determining if ETT suction was required (Chapter 5), there were five criteria that were both identified within the literature (Chapter 2) and perceived by the participants in this study as the most commonly used criteria when determining to initiate ETT suction in the clinical setting. These empirical results had implications for the design of the ESAT.

The first of these criteria was “suspected obstruction of the ETT by secretions”. As described in Chapter 2, the literature review identified that haemodynamic changes in association with acute physiological changes, attributed to the presence of secretions obstructing the ETT or lower lung fields (Ahrens & Sona, 2003; Dougherty-Wrightson & Askin, 1999; Copnell & Fergusson, 1995; Hodge, 1991; Moore, 2003; Swartz, Noonan & Edward-Beckett, 1996; Walsh, Vanderwarf, Hoscheit & Fahey, 1989; Wood, 1998). This criterion achieved the highest mean score of all the clinical indicators (M=91.7, SD 11.2, Mdn=97.0). This result indicated that participants would most likely initiate ETT suction based on “suspected obstruction” of the tube by secretions and supports the evidence that it is regarded as a useful indicator for the requirement to perform ETT suction.

The second highest ranked criteria were “visible or audible secretions within the ETT” (M=91.0, SD 8.6, Mdn=93.0). This finding suggests that many participants often use “visible or audible secretions” as a clinical indicator for initiating endotracheal suction. This concurs with that of other authors who have stated that “visible or audible secretions in the ETT” contributes in part to the respiratory assessment process (Dougherty-Wrightson & Askin, 1999; Baun, 1984; Carhuapoma & Williams, 1999; Copnell & Fergusson, 1995; Day, Wainwright & Wilson-Barnett, 2001; Dyhr, Bonde & Larsson, 2003; Gilbert, 1999; Moore, 2003; Place & Fell, 1998; Runton, 1992; Swartz, Noonan & Edward-Beckett, 1996; Wood, 1998).

The third highest ranked criterion identified was “decreased oxygen saturations or cyanosis” (M=86.4, SD 10.8, Mdn=88.5). This indicates the participants perceived “decreased oxygen saturations or cyanosis” as an often used clinical indicator for initiating endotracheal suction. As previously described in Chapter 2 there was broad reference to clinical indicators of a patient’s respiratory status that would prompt the initiation of ETT suction (Baun, 1984; Chang, 1995; Copnell & Fergusson, 1995; Dougherty-Wrightson & Askin, 1999; Gilbert, 1999; Hodge, 1991; Knox, 1992; Moore, 2003; Place & Fell, 1998; Runton, 1992; Swartz, Noonan & Edward-Beckett, 1996; Wood, 1998). Only three articles (Dougherty-Wrightson & Askin, 1999; Gilbert, 1999; Place & Fell, 1998) referred specifically to changes in “oxygen saturations” as a clinical indicator for the initiation of ETT suction.

The fourth most highly ranked criterion by participants was “suspected aspiration” (M=82.2, SD 18.7, Mdn=88.0). This result indicates that many participants used this criterion to determine if ETT suction is required. As previously stated several authors described “visible or audible secretions” or other non specified clinical indicators for the initiation of ETT suction within the literature reviewed. Only Wood (1998) specifically referred to “suspected aspiration” as a specific criterion. In this study, the mean score for how often “suspected aspiration” was used as a clinical indicator when determining if endotracheal suction was warranted.

The final highly ranked criterion was the use of “dyspnoea or signs of respiratory distress” (M=79.6, SD 15.3, Mdn=83.0). This concurs with reports by Gilbert (1999), Hodge (1991), Knox (1992) and Wood (1998) that assessment of these criteria was recommended to determine if ETT suction is required.

Results for a further eight criteria (“coughing” M=76.4, SD 17.3, Mdn=78.5; “decreased tidal volume delivery” M=75.8, SD 19.4, Mdn=83.0; “increased peak pressure” M=75.2, SD 20.6, Mdn=81.0; “auscultation (altered, diminished, abnormal air entry)” M=70.6, SD 21.7, Mdn=75.5; “increasing end tidal carbon dioxide” M= 69.3, SD 24.6, Mdn=76.5; “altered chest movement” M=68.5, SD 22.2, Mdn=71.5; “unexplained patient restlessness” M=65.2, SD 22.0, Mdn=71.0; “alteration in arterial blood gas results” M=64.4, SD 21.7, Mdn=66.5) indicated that participants were less likely to use these when determining the need for endotracheal suction. These findings differ from those in the literature where they are described as useful indicators (Baun, 1984; Chang, 1995; Copnell & Fergusson, 1995; Dougherty-

Wrightson & Askin, 1999; Gilbert, 1999; Hodge, 1991; Knox, 1992; Moore, 2003; Place & Fell, 1998; Runton, 1992; Swartz, Noonan & Edward-Beckett, 1996; Wood, 1998. The expert nurse has a knowledge base that is used not only for the simplistic interpretation of clinical indicators but also more critically when contemplating the possible implications of all identified clinical signs before any nursing action or procedure occurs. Therefore, while these eight criteria may be perceived by the participants as being used less often as individual indicators for the requirement to perform ETT suction, they may be viewed as important in the overall respiratory assessment of the patient.

Two criteria had calculated means below 60 indicating a low significance to the respondents of the questionnaire. These two criteria were “haemodynamics (unexplained changes in hear rate, BP & ICP if applicable)” M=53.3, SD 23.4, Mdn=52.0 and “unit protocols/guidelines” M=39.3, SD 33.6, Mdn=29.0. Haemodynamic changes were linked within the reviewed literature to the presence of secretions obstructing the endotracheal tube or lower lung fields (Ahrens & Sona, 2003; Dougherty-Wrightson & Askin, 1999; Copnell & Fergusson, 1995; Hodge, 1991; Moore, 2003; Swartz, Noonan & Edward-Beckett, 1996; Walsh, Vanderwarf, Hoscheit & Fahey, 1989; Wood, 1998). As previously mentioned, the expert nurse views the results of any clinical assessment in the context of the disease process and the possible implications for the patient. When taken as an independent criterion these expert nurses viewed “haemodynamics (unexplained changes in hear rate, BP & ICP if applicable)” as a poor sole indicator for the need to suction the endotracheal tube. The reviewed literature supported clinical interventions should be based on the clinical needs of the individual patient following a thorough assessment (Blackwood, 1999; Carhuapoma & Williams, 1999; Chang, 1995; Day, Farnell, Haynes, Wainwright & Wilson, 2002; Moore, 2003; Walsh, Vanderwarf, Hoscheit & Fahey, 1989).

In summary, the results clearly show that respiratory assessment factors play a major factor in choosing when endotracheal suction should be initiated. These factors include “suspected obstruction of the ETT by secretions”, “visible or audible secretions” and “suspected aspiration”. “Decreased oxygen saturation readings”, “cyanotic colour changes” and “dyspnoea or signs of respiratory distress” are also often used as indicators for initiating the procedure. Findings were not as supportive

for use of “coughing”, “increased peak pressures”, “auscultation: (altered, diminished, abnormal air entry)”, “decreased tidal volume delivery”, “increasing end tidal carbon dioxide”, “altered chest movement”, “unexplained patient restlessness”, “altered arterial blood gas results” and “haemodynamic (unexplained changes in heart rate/BP & ICP if applicable) changes”. This may indicate that while these criteria may indicate the requirement for suctioning, there may be other independent causative factors involved in the alteration in these clinical signs. Unit protocols or guidelines were less frequently used as indicators for ETT suction. Findings from this study support the current literature and clearly show that ETT suction should only be performed when clinically indicated.

6.4.3 Importance of respiratory assessment.

Although 15 criteria were identified in the literature as being crucial to the respiratory assessment process when determining whether to perform ETT suction, no reference to the level of importance of these criteria was described by any author (Ahrens & Sona, 2003; Baun, 1984; Carhuapoma & Williams, 1999; Chang, 1995; Copnell & Fergusson, 1995; Day, Wainwright & Wilson-Barnett, 2001; Dougherty-Wrightson & Askin, 1999; Durand, Sangha, Cabal, Hoppenbrouwers and Hodgman, 1989; Dyhr, Bonde & Larsson, 2003; Gilbert, 1999; Hodge, 1991; Knox, 1992; Lim et al. 2004; Moore, 2003; Oh and Sea, 2003; Place & Fell, 1998; Runton, 1992; Swartz, Noonan & Edward-Beckett, 1996; Tolles and Stone, 1990; Walsh, Vanderwarf, Hoscheit & Fahey, 1989; Wood, 1998).

Therefore, in this study, participants were asked “To rate the importance of each respiratory assessment criteria by marking an ‘x’ on the line at the point that best shows how important you believe that criteria is when determining whether to perform suction.” The line ranged from 0 to 100mm, and mean scores were calculated. The following five specific criteria achieved the highest importance ranking as clinical indicators when determining if ETT suction is required:

1. Suspected obstruction of the endotracheal tube by secretions (M=92.4, SD 9.7, Mdn=86.0).
2. Visible or audible secretions (M=89.1, SD 11.4, Mdn=93.0).
3. Decreased oxygen saturation/cyanosis (M=86.6, SD 10.8, Mdn=89.0).
4. Suspected aspiration (M=83.8, SD 17.9, Mdn=90.0).
5. Dyspnoea or signs of respiratory distress (M=82.9, SD15.8, Mdn=88.0).

Results for a further nine criteria were regarded by the participants as less important as independent indicators for determining if endotracheal suction should be performed. These criteria were “increased peak pressure”(M=79.1, SD 18.5, Mdn=85.0), “decreased tidal volume delivery” (M=78.7, SD 18.9, Mdn=85.0), “auscultation: (altered, diminished, abnormal air entry)” (M=78.0, SD 19.7, Mdn=83.0), “coughing”(M=75.9, SD 18.4, Mdn=82.0), “increasing end tidal carbon dioxide” (M=74.6, SD 21.7, Mdn=82.0), “alteration in arterial blood gas results” (M=73.6, SD 19.0, Mdn=78.0), “altered chest movement”(M=73.0, SD 20.9, Mdn=78.0), “unexplained patient restlessness” (M=67.2, SD 20.4, Mdn=72.0), and “haemodynamics (unexplained changes in heart rate/BP & ICP if applicable)” (M=62.9, SD 22.3, Mdn=66.0). The reason behind these criteria rating of less importance as individual indicators may become clearer in the analysis of the qualitative data section. The expert nurse explains their interpretation of the need for a clinical intervention may be based on a combination of assessments rather than a single criterion.

The final criteria rated was “unit protocol/guidelines” which was rated very low by participants as a reason to instigate endotracheal tube suction (M=41.3, SD 32.9, Mdn=39.0). The reviewed literature supported that clinical interventions should be based on the clinical needs of the individual patient following a thorough

assessment (Blackwood, 1999; Carhuapoma & Williams, 1999; Chang, 1995; Day, Farnell, Haynes, Wainwright & Wilson, 2002; Moore, 2003; Walsh, Vanderwarf, Hoscheit & Fahey, 1989). Perhaps if current unit protocols or guidelines reflected this then the rating may have been different for these criteria.

In summary, the criteria considered most important were “suspected obstruction of the endotracheal tube by secretions”, “visible or audible secretions”, “decreased oxygen saturations or cyanosis”, “suspected aspiration” and “dyspnoea or signs of respiratory distress”. Less important criteria included “auscultation”, “increased peak pressure”, “decreased tidal volumes”, “coughing”, “increasing end tidal carbon dioxide”, “altered arterial blood gas results”, “altered chest movement”, “unexplained patient restlessness” and “haemodynamic (unexplained changes in heart rate/BP & ICP if applicable)”. The researcher proposes that participants may consider there may be other causative factors for the signs and symptoms expressed by these criteria, thereby reducing their usefulness in specifically assessing the need to suction. Of particular note, one important finding was that “unit protocols or guidelines” played a minimal role in determining nursing action in relation to the requirement for endotracheal suction for the participants.

6.4.4 Relationship between how often the criteria were used and the rating of importance of the criterion.

The researcher determined the strength of the relationship between the use of each criteria and the rating of importance for that criterion using the Spearman rank order correlation coefficient. Lower ranked criterion had a high correlation combined with a wider spread of perceived use, which showed there was less agreement in their importance and frequency of use. For example, “haemodynamics (unexplained changes in heart rate, BP and/or ICP)” ranking low as a primary clinical criterion for determining to perform ETT suction (M=62.9, SD 22.3, Mdn=66.0) and for frequency of use ((M=55.3, SD 23.4, Mdn=52.0) had a strong positive relationship ($r_s = 0.62$, $n = 104$, $p < 0.001$).

Higher ranked criterion had lower correlation suggesting that they were regarded as being highly important whether they were used more or less frequently. For example, “decreased oxygen saturations/cyanosis” ranking high for both as a clinical criterion for determining to perform ETT suction (M=86.6, SD 10.8,

Mdn=89.0) and in frequency of use ((M=86.4, SD 10.8, Mdn=88.5) had a strong positive relationship ($r_s = 0.51$, $n = 104$, $p < 0.001$).

Findings showed that if the criterion rated high in terms of frequency of use, it also rated high in importance. As an example, “increased peak pressure” (M=75.3, SD 20.6, Mdn=81.0) was perceived by the participants as an often used individual criterion for determining if endotracheal suction is required and was also perceived by the participants as reasonably important (M=79.1, SD 18.5, Mdn=85.0). The Spearman rank order correlation coefficient demonstrated a strong positive relationship ($r_s = 0.68$, $n = 104$, $p < 0.001$).

If the criterion was used less frequently as a clinical indicator then participants had a lower regard for this when rating the criterion as a specific single indicator. For example “unit protocol/guidelines” (M=39.3, SD 33.0, Mdn=29.0) was perceived by the participants as an infrequently used criterion and also having a low perceived rating of importance (M=41.3, SD 32.9, Mdn=39.0). In further support of this interpretation of the data, the Spearman rank order correlation coefficient demonstrated the relationship ($r_s = 0.71$, $n = 104$, $p < 0.001$).

In summary, if the criterion rated high in terms of frequency of use, it also rated high in importance; if the criterion was used less frequently as a clinical indicator for the requirement for endotracheal suction then participants had a lower regard for this when rating the criterion as a specific single indicator to perform suction. Therefore, the following highly rated items were included in the ESAT: “suspected obstruction of the endotracheal tube by secretions”, “visible or audible secretions”, “decreased oxygen saturations”, “suspected aspiration” and “dyspnoea or signs of respiratory distress”. Those criteria that were considered to be used less often and rated reasonably important were “auscultation”, “increased peak pressure”, “decreased tidal volume delivery”, “coughing”, “increased end tidal carbon dioxide”, “alterations in arterial blood gas results” and “altered chest movement”. For this reason they were deemed worthy of inclusion but placed at a lower level in the list of assessment criteria in the ESAT. Those criteria that were considered to be used rarely and rated low in importance were “unexplained patient restlessness”, “haemodynamics (unexplained changes in heart rate, BP and/or ICP) and “unit protocols/guidelines” and were therefore excluded from the ESAT. Further discussion of the results for the quantitative section will follow in the limitations and strength section of this chapter.

6.5 Summary of Qualitative Results

6.5.1. Content analysis of open-ended questions.

The first open-ended question of the ESQ asked participants to “Describe as fully as possible a recent endotracheal tube (ETT) suction experience you performed. Include in your description the specific factors that influenced your decision to perform endotracheal suction for this patient”. Content analysis revealed a total of 19 criteria as follows:

- Oxygen saturation readings
- Secretions
- Coughing
- Ventilator parameters
- Respiratory assessment
- Clinical indicators
- Clinical condition
- History
- Respiratory distress
- Patient activity
- Combination of clinical factors
- Diagnostic tests
- Clinical treatments
- End tidal carbon dioxide readings
- Arterial blood gas results
- Transport of patient
- Post repositioning
- Patency of endotracheal tube

- Patient skin colour

The second open-ended question asked “What criteria (other than you have described above) do you personally consider when determining if a child requires endotracheal suction?” The rationale for this question was to determine whether any previously unidentified criteria would emerge. If so, these would be eligible for inclusion in the ESAT. The 13 criteria (codes) identified in the data from this question were:

- History of the patient’s condition
- Previous tolerance to the procedure
- Type of secretions during last shift
- A combination of clinical indicators
- Diagnosis
- Type of artificial ventilation
- Post repositioning
- Available staff to assist
- Type and size of endotracheal tube
- Inspiratory/expiratory graph changes
- Transport of patient
- Clinical needs
- Medical order

When comparing the codes identified in these open ended questions to those previously identified within the literature (Chapter 2), the following criteria were common to both: the presence of “audible or visible secretions”, “coughing”, “decreased tidal volumes”, “ventilation parameters”, “respiratory distress”, “respiratory assessment”, “patient activity”, “carbon dioxide readings”, “diagnostic testing”, “arterial blood gas analysis”, “clinical condition”, “patient skin colour”, “oxygen saturations”, “protocol or routine requirements” and “patency of endotracheal tube” (Ahrens & Sona, 2003; Baun, 1984; Carhuapoma & Williams,

1999; Chang, 1995; Copnell & Fergusson, 1995; Day, Wainwright & Wilson-Barnett, 2001; Dougherty-Wrightson & Askin, 1999; Durand, Sangha, Cabal, Hoppenbrouwers and Hodgman, 1989; Dyhr, Bonde & Larsson, 2003; Gilbert, 1999; Hodge, 1991; Knox, 1992; Lim et al. 2004; Moore, 2003; Oh and Sea, 2003; Place & Fell, 1998; Runton, 1992; Swartz, Noonan & Edward-Beckett, 1996; Tolles and Stone, 1990; Walsh, Vanderwarf, Hoscheit & Fahey, 1989; Wood, 1998).

The 13 codes (criteria) identified by the participants but not previously identified within the literature were:

- History of the patient's condition
- Previous tolerance to the procedure
- Type of secretions during last shift
- Combination of clinical indicators/factors
- Diagnosis/clinical treatments
- Type of artificial ventilation
- Post patient repositioning
- Availability of staff to assist
- Type and size of endotracheal tube
- Inspiratory/expiratory graph changes
- Was patient being prepared for transport
- Clinical needs
- Medical order

The criteria participants described in written accounts of an endotracheal suction procedure, along with additional criteria they suggested could have been used in the assessment process, were included in the design of the ESAT to reflect current practice. These criteria were: "history of patient condition", "previous tolerance to the procedure", "type of secretions during last shift", "combination of clinical indicator", "diagnosis" and "type of artificial ventilation".

Those criteria considered too general in their application or part of normal nursing practice and deemed inappropriate for the ESAT were excluded. These were: “post patient repositioning”, “availability of staff to assist”, “type and size of endotracheal tube”, “inspiratory/expiratory graph changes”, “was patient being prepared for transport”, “clinical needs” and “medical orders”.

In summary, 19 codes defined within the literature were also identified by content analysis of the two open-ended question in the ESQ. Thirteen previously unidentified criteria were found. Participants placed particular emphasis on the clinical history, diagnosis of the patient, previous response to ETT suction, clinical stability, current mode of artificial ventilation, availability of staff to assist in the procedure and stability of airway prior to transport in relation to clinical assessment and therapy. These results support the inclusion of the “Clinical Considerations” section of the ESAT.

6.6 Comparing the Theoretical Framework with Empirical Evidence

The aim of this study was to establish the current criterion most commonly used to assess the clinical status of the patient, and based on this assessment, whether to initiate endotracheal suction. The second aim was to rank the criteria used in the assessment process in terms of importance. Once these factors had been established the Endotracheal Suction Assessment Tool (ESAT) could then be designed.

The conceptual framework guiding this study was based on Orlando’s nursing process (Marriner-Tomey & Raile-Alligood, 2002). Orlando established the concept that assessment is an integrated process involving observation, reporting and action. Marriner-Tomey and Raile-Alligood (2002) supports Orlando’s concept that the professional nurse is finding out and meeting the patient’s immediate need for help. For the ventilated child, who can neither communicate nor meet his/her own needs, it is crucial the nurse caring for this patient constantly observes, assesses and acts in the best interests of his/her patient. The ventilator dependent patient can have complex care issues and either nursing action or inaction can seriously impact on the clinical stability of the patient. The responses and actions of the nurse to these patient needs are dependent upon the experienced nurse using observed clinical evidence in order to carefully consider all patient-related signs and symptoms before undertaking a

procedure such as endotracheal suction that carries specific and potentially harmful risks to the clinical stability of the patient. The results from the Endotracheal Suction Questionnaire have established that the nurse at the bedside consistently assesses the patient's respiratory, cardiovascular and ventilator status and makes carefully considered and informed decisions regarding the need for ETT suction. These assessment criteria have been prioritised and evaluated using the input from experienced nurses caring for the critically ill paediatric patient to form the basis of the ESAT design. The ESAT is an accumulation of their collective experience to assist in the decision making process to enhance current nursing practice through observation and appropriate nursing response.

6.7 Limitations and Strengths

6.7.1 Limitations.

The preliminary validation process of the Endotracheal Suction Questionnaire (ESQ) used in this study was considered appropriate given the time constraints of a Masters study. This testing could have been further strengthened by more rigorous testing of the ESQ for test-retest reliability and further validity testing. However, this was not possible given the time constraints of such a study.

Response rates for questionnaires administered to nurses vary between 15-50% (Burns, 2000). While the response rate of 22% from Australian PIC nurses and 51% from experienced New Zealand PIC fell within common response rates there were a number of experienced nurses who chose not to participate. Therefore, biased sampling particularly from the Australian participants, cannot be excluded and as such there may have been additional criterion influencing the decision making processes for ETT suction that were not identified, due to non-participating experienced nurses.

While the use of a questionnaire is cost effective and eliminates researcher bias it can create limitations. These include but are not limited to uncertainty over who actually completes the questionnaire, difficulty ensuring participants do not compare answers, difficulty ensuring participation is based on the participant's goodwill and finally, that any difficulty participants may experience with questions cannot be addressed by the researcher. If questionnaires are not returned, are

incomplete, or there are insufficient numbers of participants, rigorous data analysis may not be possible. While inclusion of open-ended questions improves the quality of data and can address omission of important data obtained from the rigidity of quantitative questions, it may produce information that cannot be easily translated into useable data. Interpretation of qualitative data may be biased by the researcher's perceptions and judgements that may affect the possible selection and observation of relevant information.

The value and perceived usefulness of the newly developed ESAT can only be ascertained after widespread testing and implementation in the clinical environment. This is beyond the scope of this Master's study, but would be necessary to fully assess the tool's effectiveness in improving practice and patient outcomes.

6.7.2 Strengths.

The topic was well researched and the analysis of the current literature was thorough. The theoretical framework used had direct application to the clinical setting. The use of the Endotracheal Suction Questionnaire (ESQ) enabled experienced nurses from a wide range of varied work environments who care for the critically ill paediatric patient to participate. The ESQ was quick and easy to complete. The response rate was over 20% from both the Australian and New Zealand participants, thus minimising some potential sampling errors and bias (Burns, 2000; Edwards et al. 2002). There was a clear correlation between the practices described within the literature and the current practice of Australian and New Zealand's experienced PIC nurses working within paediatric intensive care. The data not only identified the most commonly used clinical criteria used for the initiation of endotracheal suction but also the criteria considered to be most important. Modifying the selection criteria to include those expert nurses involved in the stabilisation and transport of the critically ill child identified useful data on current nursing practice relevant to the study. Further, use of the open ended questions allowed for the identification of criteria not previously discussed within the literature, strengthening the comprehensiveness of the newly designed ESAT.

In summary, this study followed a systematic approach in obtaining clinically relevant information to support the final design format of the ESAT. However, as

previously stated the true value of the study will only be established if the ESAT is trialled within the clinical setting.

CHAPTER 7

CONCLUSION, IMPLICATIONS AND RECOMMENDATIONS

The analysis of currently available literature for determining whether to perform endotracheal suction revealed a range of criteria. The literature was not specifically targeted to paediatric patients requiring intensive care, rather to neonatal or adult intensive care patients. There was minimal reference to paediatric intensive care patients. The literature showed inconsistency and a lack of comprehensiveness of criteria. Furthermore, criteria identified could not be translated directly to the paediatric setting. As a result, this combined quantitative and qualitative study was designed and implemented using Orlando's Nursing Process as the guiding theoretical framework.

The study comprised four phases. Phase One was a comprehensive review of the literature to determine currently used clinical criteria for endotracheal tube (ETT) suction, followed by the design of an Endotracheal Suction Questionnaire (ESQ) based on findings from the literature review and the researcher's clinical experience. Phase Two comprised validity testing and refinement of the ESQ. In Phase Three the ESQ was administered to experienced PIC nurses within Australia and New Zealand in order to validate criteria and identify current practice. Finally, in Phase Four an evidence based Endotracheal Suction Assessment Tool (ESAT) based on the findings from the previous phases was developed.

This study revealed that the assessment of the patient's clinical signs and symptoms is a complex process requiring skilled interpretation. Key points that emerged from the study include:

- The rigorous development and validation processes used for the ESQ.
- Agreement between the literature reviewed and current practice within Australian and New Zealand paediatric intensive care units.
- No single criteria are representative of the requirement to perform ETT suction.
- A number of other criteria were identified by the study that had not previously been described within the literature.
- Diagnosis, clinical history, previous response to ETT suction, clinical stability, current artificial ventilation mode and preparation for transport all have an impact on the decision process involved in evaluating the requirement to perform ETT suction
- ETT suction should only be performed based on the clinical condition and requirements of the individual patient, rather than standardised unit protocols or guidelines.
- The development of the ESAT that was based on the empirical evidence generated from this study.

Whilst this study has followed a systematic process of a literature review, input from specialist clinicians in Paediatric Intensive Care and objective data analysis, the clinical utility of the ESAT as yet remains to be tested.

7.1 Implications

The empirical evidence provided by this paediatric nursing study is unique in the area of endotracheal suction. This research has also highlighted the need for nurses to consider not only the immediate clinical status of the ventilated child, but also the short and longer term risks associated with endotracheal suction. Furthermore, this study has finally confirmed a number of long held beliefs that in the past were based on anecdotal evidence.

This study demonstrated the application of sound research to the development of an evidence based education tool for nurses working in the paediatric intensive care area. The aim of the ESAT is to provide a tool to assist inexperienced nurses working within PIC in the decision making process for the requirement for endotracheal suction. The developed tool could be used to formalise and establish more uniform assessment to guide nurses in the decision making process and potentially result in more consistent, evidence based practice to achieve better patient outcomes.

7.2 Clinical Nursing

1. Endotracheal tube suction should only be performed based on the clinical condition and requirements of the individual patient, rather than standardised unit protocols or guidelines.
2. Unit protocols and guidelines should be updated to reflect the change from set routine to individual clinical need in regards to endotracheal tube suction.
3. There is now scientific evidence to support the literature reviewed and current practice within Australian and New Zealand paediatric intensive care units.

7.3 Research

1. Further testing of the ESQ for validity and test-retest reliability.
2. Validation and reliability testing of the ESAT, and evaluation of its usefulness within the clinical setting by inexperienced PIC nurses.
3. How questionnaire design and distribution could better target the identified group to improve sample size and diversity of population.

7.4 Education

1. Paediatric intensive care nurses should be educated about the evidence to support the practice that endotracheal tube suction should only be performed when clinically indicated.
2. Paediatric intensive care nurses should be educated about the criteria used to assess the requirement for endotracheal tube suction.

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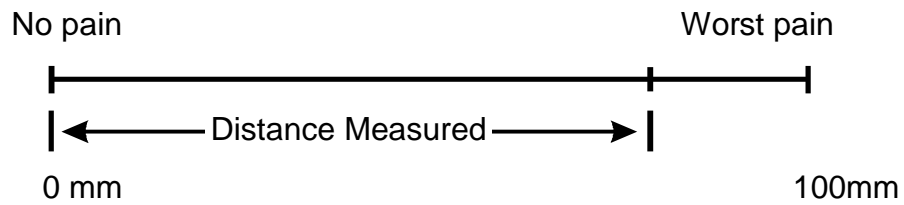
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APPENDIX 1

Visual Analogue Scale



Visual Analogue Scales: <http://www.vet.ed.ac.uk/animalpain/Pages/VAS.htm>

APPENDIX 2



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ABN 54 381 485 361

CRICOS IPC 002798

22nd June, 2006

Mrs Kylie Davies
[Redacted]

Dear Mrs Davies,

I am pleased to write on behalf of the Higher Degrees Committee of the Faculty of Computing, Health & Science, to advise that your Master's research proposal has been approved – Determining Standard Criteria for Endotracheal Suctioning in the Paediatric Intensive Care Patient: A Descriptive Survey.

I also wish to confirm that your proposal complies with the provisions contained in the University's policy for the conduct of ethical research, and your application for ethics clearance has been approved. Your ethics approval number is 05-221 and the period of approval is: 14 November 2005 – 3 June 2007.

You may now commence your data collection.

Approval is given for your supervisory team to consist of:

Principal Supervisor: A/Prof Leanne Monterosso
Associate Supervisor: A/Prof Gavin Leslie

The examination requirements on completion are laid down in *Part VI of The University (Admissions, Enrolment and Academic progress) Rules for Courses Requiring the Submission of Theses* available at: <http://www.ecu.edu.au/GPPS/legislation/rules.php>

Additional information and documentation relating to the examination process can be found at the Graduate School website: <http://www.ecu.edu.au/GraduateSchool/>

Please note: the Research Students and Scholarship Committee has resolved to restrict Master by Research (1 year) theses to a maximum of 40,000 words or a Master by Research (2 year) theses to a maximum of 60,000 words. Under special circumstances a candidate may seek approval from the Faculty Research and Higher Degrees Committee for an extension to the word length [RSSC 33/04].

I would like to take this opportunity to offer you our best wishes for your research and the development of your thesis.

[Redacted Signature]
Karen Leckie
Manager
Graduate School

APPENDIX 3



Department of Health
Government of Western Australia



Mrs Kylie Davies
[REDACTED]

Dear Mrs Davies

REGISTRATION NUMBER: 1300/EP

TITLE: Determining standard criteria for endotracheal suction in the paediatric intensive care patient: A descriptive survey

REFERENCE NUMBER: EC06-77

MEETING DATE: 17 August 2006

The Ethics Committee has recommended approval be given for you to undertake the abovenamed research study. This recommendation has been ratified by the Princess Margaret Hospital.

The Ethics Committee does however wish to be informed immediately of:

- I. any untoward effects experienced by any participant in the trial where those effects in degree or nature were not anticipated by the researchers, and steps taken to deal with these,
- II. substantial changes in the research protocol together with an indication of ethical implications, and
- III. other unforeseen events.

The Ethics Committee has been charged with the responsibility of keeping the progress of all approved research under surveillance. A copy of the final result must be forwarded to the Committee upon completion of the research or if the research is not completed within twelve months you are asked to submit a progress report and annually thereafter. This information should include:

- b) The status of the project (completed/in progress/abandoned/not commenced). In the event that a project does not commence within 12 months of being approved by the Ethics Committee the study must be resubmitted to the Committee for approval.

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- c) Compliance with conditions of ethical approval, including security of records and procedures for consent.
- c) Compliance with any special conditions stated by the Ethics Committee as a condition of approval.
- d) Results from the study to date, including outcome.

Please note that approval for studies is for three years and the research should be commenced and completed within that period of time. Projects must be resubmitted if an extension of time is required. In the event that a project does not commence within 12 months of being approved by the Ethics Committee the study must be resubmitted to the Committee for approval.

Please quote the above registration number on all correspondence.

Yours sincerely



**Dr Geoff Masters
Executive Director
Medical Services**

23 August 2006

- **The Ethics Committee is constituted, and operates in accordance with the National Health and Medical Research Council's National Statement on Ethical Conduct in Research Involving Humans**

APPENDIX 4

To _____

Proposal Outline

Introduction: Endotracheal tube (ETT) suction is a common procedure within the paediatric intensive care setting to remove secretions. A comprehensive literature review established that there are significant clinical side effects associated with the procedure that can dramatically affect the stability of the critically ill paediatric patient on a ventilator. Justification for performing this procedure depends on a number of clinical indicators. The literature review failed to establish clear standards for determining if the procedure is warranted, especially for paediatric patients.

Aim of the Research: The aim of the research is to design an endotracheal suction assessment tool (ESAT) for use by nurses working in paediatric intensive care units (PICU). The tool would be used to guide the accurate assessment of the need for endotracheal suction, specifically in paediatric patients who are intubated and ventilated. It is anticipated that use of the ESAT will improve nursing practice and patient care of patients with an artificial airway in situ.

Method: This 4 phase study uses both quantitative and qualitative methodological approaches. Phase One will involve a literature review to determine current ETT suction criteria, as well as the design of an ETT Suction Questionnaire (ESQ). In phase two, validity testing of the ESQ will be undertaken with six experienced paediatric nurses from Princess Margaret Hospital. In phase three, the ESQ will be distributed to experienced nurses in all Australia and New Zealand who work within paediatric intensive care units to determine current practice. Experienced nurses for both phase two and three are defined as those with 5 or more years working within PICU or who have a postgraduate qualification in paediatric intensive care. In phase four, data from all previous phases will be analysed and used to develop the ESAT.

Significance: The proposed research will have a significant impact on patient care by standardising and improving nursing practice through the development of the first evidence based clinical assessment tool for ETT suction. Use of the combined qualitative and quantitative approach in creating this assessment tool should promote the future development of similar assessment tools for other areas of patient care.

Ethical considerations: Include maintaining confidentiality of personal data from participants in phase two, and phase three. In phase two, informed consent will be obtained from the participants who will be involved in testing and validating the ESQ. In phase three, consent forms will not be required as the return of questionnaires by participants will imply consent. Data in this phase, therefore, will be unidentifiable. Ethical approval has been sought and received from Edith Cowan University and Princess Margaret Children's Hospital.

APPENDIX 5

Thank you for agreeing to, be part of phase two of my research, to review the clarity, content validity and internal consistency of the Endotracheal Suction Questionnaire.

Your participation in this part of my research project is invaluable and greatly appreciated.

Please find enclosed in your information package the following:

- a. Consent form as your feedback in completing the review may be used as part of my research.
- b. The Endotracheal Suction Questionnaire (ESQ) to be reviewed.
- c. Checklist A with instructions to determine the clarity of the ESQ.
- d. Checklist B with instructions to determine the content validity of the ESQ.
- e. Checklist C with instructions to determine the internal consistency of the ESQ.

If any part of your package is missing please contact me by either:

Phoning 08 [REDACTED]

Email: kdavies@daypub.com.au

If you require further explanation for your role in reviewing the ESQ please contact me by the above process.

Please complete the review by _____ & return to me by the enclosed pre-paid envelope.



APPENDIX 6



PARTICIPANT CONSENT FORM FOR PHASE TWO

FORM OF CONSENT

I _____ have read the

Given Names

Surname

Information explaining the study titled “Determining Standard Criteria for Endotracheal Suctioning in the Paediatric Intensive Care Patient: A Descriptive Survey.”

I have read and understood the information given to me and the requirements of my participation in Phase Two of this study. Any questions I have asked have been answered to my satisfaction.

I understand I may withdraw from the study at any stage and withdrawal will not interfere with my job.

I agree the research data gathered from the results of this study may be published, provided that names are not used.

Dated day of20.....

Participant's Signature:

APPENDIX 7

CHECKLIST A – CLARITY OF ENDOTRACHEAL SUCTIONING QUESTIONNAIRE

Instructions Sheet:

Please read the entire questionnaire first.

(a) Are the questionnaire instructions clear? Circle either yes or no on the next line.

YES NO

(b) Read each question in the questionnaire separately that corresponds to the same number on the attached response sheet. Beside each question number on the response sheet circle: **C (clear)** or **U (unclear)** to indicate whether the question is **clear** or **unclear** to you.

After you finish you may wish to discuss your comments with the researcher.

Thank you for your assistance in assessing the clarity of the questionnaire design.

(Lynn, 1986).

Code

Response Sheet for Checklist A – Clarity

Please indicate whether each question is **C (clear)** or **U (unclear)** to you.

		Circle One	Comments
1	C	U	
2	C	U	
3	C	U	
4	C	U	
5	C	U	
6	C	U	
7	C	U	
8	C	U	
9 a	C	U	
9 b	C	U	
9 c	C	U	
9 d	C	U	
9 e	C	U	
9 f	C	U	
9 g	C	U	
9 h	C	U	
9 i	C	U	
9 j	C	U	
9 k	C	U	
9 l	C	U	
9 m	C	U	
10 a	C	U	
10 b	C	U	
10 c	C	U	
10 d	C	U	
10 e	C	U	
10 f	C	U	
10 g	C	U	

10 h	C	U	<hr/>
10 i	C	U	<hr/>
10 j	C	U	<hr/>
10 k	C	U	<hr/>
10 l	C	U	<hr/>
10 m	C	U	<hr/>
11 a	C	U	<hr/>
11 b	C	U	<hr/>

(Lynn, 1986).

APPENDIX 8

CHECKLIST B – CONTENT VALIDITY OF ENDOTRACHEAL SUCTIONING QUESTIONNAIRE

Instructions Sheet:

In this section, you are asked to look at the questions in the questionnaire and decide if you think they seem to flow easily in a logical order.

Read the entire questionnaire first. After you finish reading the questionnaire, answer question (a) at the top of the response sheet- either **YES** or **NO**. Then answer question (b) for each question in the questionnaire. Answer by circling the response you choose under question (b) – either **Y (YES)** or **N (NO)**. Please add any relevant comments you wish to explain your answers.

Thank you for your assistance in assessing the content validity of the questionnaire design.

(Lynn, 1986).

Code

Response Sheet for Checklist B – Content Validity

Label: Respiratory assessment criteria for the requirement of endotracheal suctioning to be initiated.

Definition: The questionnaire is intended to identify the criteria used to determine the requirement for endotracheal suctioning in the paediatric intensive care patient.

(a) In general, do the label and definition fit the whole set of questions in the questionnaire? Answer once for the whole questionnaire by circling either **YES** or **NO** on the next line.

YES

NO

(b) Does each question fit the label and definition? Please circle **Y (YES)** or **N (NO)**.

Circle One

Comments

1	Y	N	
2	Y	N	
3	Y	N	
4	Y	N	
5	Y	N	
6	Y	N	
7	Y	N	
8	Y	N	
9 a	Y	N	
9 b	Y	N	
9 c	Y	N	
9 d	Y	N	
9 e	Y	N	
9 f	Y	N	
9 g	Y	N	
9 h	Y	N	
9 i	Y	N	

9 j	Y	N	<hr/>
9 k	Y	N	<hr/>
9 l	Y	N	<hr/>
9 m	Y	N	<hr/>
10 a	Y	N	<hr/>
10 b	Y	N	<hr/>
10 c	Y	N	<hr/>
10 d	Y	N	<hr/>
10 e	Y	N	<hr/>
10 f	Y	N	<hr/>
10 g	Y	N	<hr/>
10 h	Y	N	<hr/>
10 i	Y	N	<hr/>
10 j	Y	N	<hr/>
10 k	Y	N	<hr/>
10 l	Y	N	<hr/>
10 m	Y	N	<hr/>
11 a	Y	N	<hr/>
11 b	Y	N	<hr/>

(c) Is the question unique, ie not repetitive? Please circle **Y (YES)** or **N (NO)**.

Circle One			Comments
1	Y	N	_____
2	Y	N	_____
3	Y	N	_____
4	Y	N	_____
5	Y	N	_____
6	Y	N	_____
7	Y	N	_____
8	Y	N	_____
9 a	Y	N	_____
9 b	Y	N	_____
9 c	Y	N	_____
9 d	Y	N	_____
9 e	Y	N	_____
9 f	Y	N	_____
9 g	Y	N	_____
9 h	Y	N	_____
9 i	Y	N	_____
9 j	Y	N	_____
9 k	Y	N	_____
9 l	Y	N	_____
9 m	Y	N	_____
10 a	Y	N	_____
10 b	Y	N	_____
10 c	Y	N	_____
10 d	Y	N	_____
10 e	Y	N	_____
10 f	Y	N	_____
10 g	Y	N	_____
10 h	Y	N	_____

10 i	Y	N	
10 j	Y	N	
10 k	Y	N	
10 l	Y	N	
10 m	Y	N	
11 a	Y	N	
11 b	Y	N	

(d) Please write down any questions you think should be added to the questionnaire?

This image shows a blank sheet of white paper with horizontal ruling lines. The lines are evenly spaced and run across the width of the page. There are no margins, text, or other markings on the paper.

(Lynn, 1986).

APPENDIX 9

Checklist C – Internal Consistency of Endotracheal Suctioning Questionnaire

Instructions Sheet:

In this section, you are being asked to look at questions in the questionnaire and decide if you think they seem to belong together.

Read the entire questionnaire first. After you finish reading the questionnaire, answer question (a) at the top of the Response Sheet, then answer the following question (b) for each question in the questionnaire. Answer by circling the response you choose under question (b). Add any comments you wish to explain your answers.

Thank you for your assistance in assessing the internal consistency of the questionnaire design.

(Lynn, 1986).

Code

Response Sheet for Checklist C – Internal Consistency

- a) Do these questions generally belong together? Answer once for the whole questionnaire by circling either **YES** or **NO** on the next line.

YES

NO

- b) Does each question belong in the questionnaire? Please circle **Y (YES)** or **N (NO)**.

Circle One

Comments

1	Y	N	_____
2	Y	N	_____
3	Y	N	_____
4	Y	N	_____
5	Y	N	_____
6	Y	N	_____
7	Y	N	_____
8	Y	N	_____
9 a	Y	N	_____
9 b	Y	N	_____
9 c	Y	N	_____
9 d	Y	N	_____
9 e	Y	N	_____
9 f	Y	N	_____
9 g	Y	N	_____
9 h	Y	N	_____
9 i	Y	N	_____
9 j	Y	N	_____
9 k	Y	N	_____
9 l	Y	N	_____
9 m	Y	N	_____
10 a	Y	N	_____
10 b	Y	N	_____

10 c	Y	N	<hr/>
10 d	Y	N	<hr/>
10 e	Y	N	<hr/>
10 f	Y	N	<hr/>
10 g	Y	N	<hr/>
10 h	Y	N	<hr/>
10 i	Y	N	<hr/>
10 j	Y	N	<hr/>
10 k	Y	N	<hr/>
10 l	Y	N	<hr/>
10 m	Y	N	<hr/>
11 a	Y	N	<hr/>
11 b	Y	N	<hr/>

(Lynn, 1986).

APPENDIX 10

VALIDATION TESTING ENDOTRACHEAL SUCTIONING QUESTIONNAIRE

Section 1 Demographical Information

Code Number:

1. Designation:

RN ☐ CN ☐ CNS ☐ Other (please state)

2. Age: _____.

3. Male ☐ **Female** ☐

4 Number of years of experience working in Paediatric Intensive/Critical Care:

5 Experience in other Critical Care areas (please tick which is appropriate & write the number of years experience in these areas)

1. Neonatal Intensive Care	<input type="checkbox"/>	Number of Years	_____
2. Adult Intensive Care	<input type="checkbox"/>	Number of Years	_____
3. Coronary Care	<input type="checkbox"/>	Number of Years	_____

6. Have you completed postgraduate qualifications in any of the following courses? (please tick all that apply):

Neonatal Intensive Care Course	Yes	<input type="checkbox"/>	No	<input type="checkbox"/>
Paediatric Intensive Care Course	Yes	<input type="checkbox"/>	No	<input type="checkbox"/>
Adult/Coronary Care Intensive Care Course	Yes	<input type="checkbox"/>	No	<input type="checkbox"/>

7. How would you describe the level of care within your unit (Please tick all that apply):

Level 1 - Children at high risk of their condition deteriorating, or those in critical conditions. Their needs can be met in the specialised PICU ward with additional support and advice from the critical care team. ☐

Level 2 - Children requiring more detailed care, observation or intervention including support for a single organ system or post-operative care. ☐

Level 3 - Children requiring advanced respiratory support alone or basic respiratory support together with support of at least two organ systems. This level includes all complex patients requiring support for multi-organ failure. ☐

8. Please state the name of the hospital in which you are currently employed.

Section 2 Criteria on ETT Suctioning

9) Respiratory Assessment Criteria

For each of the following criteria please **mark an 'x' on the line** at the point that best shows how often you use the criteria when determining if endotracheal suction is required.

For example: How often do you use *the criteria of whether chocolate is good for your health* before determining whether to eat it? (The x indicates that this criteria is seldom used).

Not at all	_____X_____	Always
------------	-------------	--------

a. Dyspnoea or signs of respiratory distress.

Not at all _____ Always

b. Auscultation: (altered, diminished, abnormal air entry).

Not at all _____ Always

c. Decreased oxygen saturation/cyanosis.

Not at all _____ Always

d. Visible or audible secretions.

Not at all _____ Always

e. Coughing.

Not at all _____ Always

f. Altered chest movement.

Not at all _____ Always

g. Queried aspiration.

Not at all _____ Always

h. Haemodynamics (unexplained changes in heart rate/BP & ICP if applicable).

Not at all _____ Always

i. Alteration in arterial blood gas results.

Not at all _____ Always

j. Decreased tidal volume delivery.

Not at all _____ Always

k. Increasing end tidal CO₂.

Not at all _____ Always

l. Increased peak pressure.


Not at all _____ Always

m. Unexplained patient restlessness.

Not at all _____ Always

10) To rate the importance of each respiratory assessment criteria please mark an 'x' on the line at the point that best shows how important you believe that criteria is when determining whether to perform suction.

For example: How important do you consider *the criteria of whether chocolate is good for your health* before determining whether to eat it? (The x indicates that this criteria is not very important).

<i>Not at all important</i>	_____ 	<i>Very Important</i>
-----------------------------	---	-----------------------

a. Dyspnoea or signs of respiratory distress.

Not at all important _____ *Very Important*

b. Auscultation: (altered, diminished, abnormal air entry).

Not at all important _____ *Very Important*

c. Decreased oxygen saturation/cyanosis.

Not at all important _____ *Very Important*

d. Visible or audible secretions.

Not at all important _____ *Very Important*

e. Coughing.

Not at all important _____ *Very Important*

f. Altered chest movement.

Not at all important _____ *Very Important*

g. Queried aspiration.

Not at all important _____ *Very Important*

h. Haemodynamics (unexplained changes in heart rate/BP & ICP if applicable).

Not at all important _____ *Very Important*

i. Alteration in arterial blood gas results.

Not at all important _____ *Very Important*

j. Decreased tidal volume delivery.

Not at all important _____ *Very Important*

k. Increasing end tidal CO₂.

Not at all important _____ *Very Important*

l. Increased peak pressure.

Not at all important _____ *Very Important*

m. Unexplained patient restlessness.

Not at all important _____ *Very Important*

11. For the following questions, if more space is required to write your answers please use a separate sheet and attach it to the back of this questionnaire – Thank you.

a Describe as fully as possible a recent ETT suction experience you performed. Include in your description the specific factors that influenced your decision to perform endotracheal suction for this patient.

b What criteria (other than you have described above) do you use for determining if a child requires endotracheal suction? (e.g. alteration in the pressure curve on the graphic display of the ventilator).

**Thank you for taking the time to complete this form – please
enclose within the attached envelope for return.**

APPENDIX 11

Dear Kylie

The Board have approved for your survey to be emailed to our members who have indicated they are willing to be contacted via email for research purposes.

The cost for this is \$200 and an invoice will be sent to you after the email is sent. Are you happy for this to be sent early next week – we sent another research survey out the end of last week, so it is good to have some time between them.

Thanks

Libby McMahon

Executive Officer

Australian College of Critical Care Nurses Ltd

Telephone: (03) 9347 8577

Email: libbym@accn.com.au

National Office Telephone: 1800 357968

Website: www.accn.com.au

The ACCCN National Meeting, **Institute Continuing Education (ICE) Meeting** will be held on the 4th and 5th May 2007 at the Adelaide Hilton, South Australia.

ICE is a unique opportunity offered by the ACCCN for all critical care nurses whether they are a novice or highly experienced to enhance their professional career with knowledge, information and networking.

To view the program click

<http://www.accn.com.au/index.php?option=content&task=blogcategory&id=7&Itemid=64>



APPENDIX 12



Covering Letter for Directors of Nursing (DONs)

23/01/2005

Dear (Insert DON name & Hospital name)

As per the telephone conversation on the (insert date) outlining my research proposal please find enclosed a written explanation of the research proposal, consent form for me to conduct my research within your hospital, a self addressed envelope to return the consent and a copy of the research questionnaire.

Thank you for allowing me to conduct my research within your hospital it is greatly appreciated.

Please be assured all information will be confidential and at no time will any staff be identified. The questionnaires will be coded and any identifying information will be kept separately from the questionnaires.

If at any time concern is raised about either the research topic or my conduct in gaining the data required please feel free to contact me either by

E-mail: Kylie.Davies@health.wa.gov.au or

Phone: (08) [REDACTED] or at the above address.

Supervisors Name: Dr Leanne Monterosso

Associate Professor of Paediatric Healthcare

School of Nursing, Midwifery and Postgraduate Medicine

Edith Cowan University.

Ph: [REDACTED] (International callers replace 08 with 61 8)

Thank you once again.

Yours sincerely

Kylie Davies

Master of Nursing Student, Edith Cowan University

OUTLINE OF STUDY FOR DIRECTORS OF NURSING

A literature review established that there are significant clinical side effects associated with endotracheal (ETT) suction. Though ETT suction is a common procedure within the paediatric intensive care setting the justification for the procedure to occur is based on varying clinical assessments of the patient.

There are varying degrees in the level of experience and knowledge of the nursing staff working within this area. The clinical assessment of the patient may be inadequate as a direct result of either the knowledge deficit or inexperience of staff despite the patient's requirement or not for ETT suction.

As the current trend within the clinical setting is to establish evidenced-based practice criteria it seems appropriate to develop an endotracheal suction assessment tool (ESAT) to assist in patient assessment for indicators determining the requirement for ETT suction.

The primary aim of the proposed research is to compare the criteria currently used to determine the requirement for endotracheal suction in PICU's with the criteria identified in the current literature.

The criteria currently used in clinical practice will be identified through the completion of a questionnaire.

All information obtained will be confidential. Targeted paediatric intensive care units are within Australia and New Zealand. Based on this data acquired an endotracheal suction assessment tool will be developed to assist in determining the requirement for endotracheal suction.

I require either the contact details for the Clinical Nurse Manager of your paediatric intensive care unit or the Research Nurse for this area to assist in identifying staff who meet the experienced nurse criteria and in the delivery of the questionnaire to these staff members.

Thank you for your assistance in this matter.

Kylie Davies

Masters Candidate

APPENDIX 13

CONSENT FORM FOR DIRECTORS OF NURSING

In signing this consent form I understand I am giving permission for Kylie Davies to conduct her research on endotracheal suction within

_____ hospital.

I give permission that she may contact either the Clinical Nurse Manager of the Paediatric Intensive Care Unit or the Research Nurse associated with the unit.

I understand that staff within this area with 5 years or more experience will be contacted to complete a questionnaire.

I give permission for these staff to be identified and contacted to ask for their involvement in the research proposed. I understand that the information will be kept confidential.

I understand the research is aimed at improving nursing practice and patient care. I understand that at anytime if concern is raised about either the research topic or the conduct in gaining the data I may contact the researcher.

I understand that the results of the research may be given to me on request.

I agree the research data gathered from the results of this study may be published, provided that names are not used.

Date: _____

DON signature: _____

1. Clinical Nurse Manager of the Paediatric Intensive Care Unit:

Name: _____

E-mail: _____

Phone number: _____

2. Nurse Researcher:

Name: _____

E-mail: _____

Phone number: _____

(Please photocopy for your records and send the original with the contact details below via the enclosed self addressed envelope – thank you)



APPENDIX 14



INFORMATION FOR AUSTRALIAN RESEARCH PARTICIPANTS

Introduction:

You are invited to participate in research on endotracheal suction. Before you make your decision to participate please take as much time as you require to read the following information. If you are unclear about any of the information or would like more information, please ask Kylie Davies.

What are the aims of this study?

The aim of this study is to develop an Endotracheal Suction Assessment Tool (ESAT) based on data obtained from the Respiratory Assessment Questionnaire. The ESAT will provide evidence based practice as a guide for nursing practice within PIC to improve patient care.

Who is doing this study?

The researcher is Kylie Davies a Clinical Nurse working at Princess Margaret Children's Hospital (PMH), in the Paediatric Intensive Care Unit. The study is being conducted as part of her Masters of Nursing Research. Dr Leanne Monterosso from PMH and Edith Cowan University (ECU) will be the researcher's supervisor.

Why have I been chosen?

Nurses with 5 or more years of experience working in PICU will be asked to complete the questionnaire, as they meet the selection criteria.

What will be expected of you?

If you decide to participate in this study, you need to complete the enclosed consent form and questionnaire. The questionnaire is in three parts. The first contains questions about demographic information. The second part requires you to firstly identify how often you use specific criteria in determining if your patient requires endotracheal (ETT) suction through marking a cross along a scale. The second component of part two requires you to rate the importance of each criteria by marking a cross along a scale.

The third section involves questions about your clinical practice in relation to ETT suction. The aim is to identify any criteria you use in determining if ETT suction is required that has not been identified in the previous section. Please return these documents in the reply paid envelope. The questionnaire should take no longer than 30 minutes to complete. You have 2 weeks to complete & return the questionnaire.

Thank you for consenting to take the time to complete the attached endotracheal suctioning questionnaire. Please find enclosed a tea bag to drink whilst you complete the questionnaire, a chocolate for brain food and an origami animal as a memento of your participation.

How will your privacy be protected?

To protect your privacy and keep your personal details confidential the following steps will be taken:

1. Each hospital contacted for the research will provide a name of either the Clinical Nurse Manager of the PICU area or Nurse Researcher for the area to identify nursing personnel who meet the selection criteria.
2. The consent form and questionnaire will be sent to you in a sealed envelope.
The questionnaire will be completely anonymous with no identifying names or code numbers.
3. Coding of the questionnaire will occur on return of the questionnaire by the researcher only.
4. The coded questionnaires and information-identifying participants will be kept separately and no third party is involved in collecting the data once the questionnaire is completed to ensure confidentiality. All information on the coding will be kept under lock & key at ECU with the researcher and her supervisor only having access.
5. The data will be destroyed 5 years after publication.
6. You will not be identified in any way to the researcher's supervisor either during the study, or in reports published following completion of the study.

Voluntary participation and your right to refuse:

It is important for you to know that involvement in the research project is voluntary. If, after agreeing to participate in the research you later change your mind, you may withdraw your consent at any time, simply by informing the researcher (see below for contact number or e-mail address).

Are there any risks involved in the study?

There are no known risks to you in this study. If, however, your participation raises questions or concerns that you wish to discuss with the researcher, please contact Kylie Davies (see below) and she will be happy to address any concerns or questions you have.

Who has given permission for this study to proceed?

The ECU Human Research Ethics Committee has approved this research project.

The Women's and Children's Hospital in Perth, Western Australia's Ethics Committee has given consent for the pilot testing of the questionnaire.

Your hospital has been contacted and consent for participation obtained from the Director of Nursing. If you have any concerns or complaints about the project and wish to talk to an independent person, please contact the Research Ethics Officer, ECU Human Research Ethics Committee, Phone (08) 6304 2170 or Email research.ethics@ecu.edu.au

Who can you contact if you have questions about the study?**Who can you contact if you have questions about the study?**

Kylie Davies:

E-mail – Kylie.Davies@health.wa.gov.au or

Phone - (08) 9340 8165 or

Supervisors Name: Dr Leanne Monterosso

Associate Professor of Paediatric Healthcare

School of Nursing, Midwifery and Postgraduate Medicine

Edith Cowan University

Ph: [REDACTED] (International callers replace 08 with 61 8) or

Ethics Committee at Edith Cowan University

research.ethics@ecu.edu.au

THANK YOU AGAIN FOR YOUR PARTICIPATION.



APPENDIX 15



INFORMATION FOR NEW ZEALAND RESEARCH PARTICIPANTS

Title of Research: “Determining Standard Criteria for Endotracheal Suctioning in the Paediatric Intensive Care Patient: A Descriptive Survey”.

Lay Title: How do experienced nurses working in a paediatric intensive care unit determine when they should clear a patient’s artificial breathing tube?

Introduction:

You are invited to take part in research on endotracheal suction. Before you make your decision to participate please take as much time as you require to read the following information. If you are unclear about any of the information or would like more information, please contact either Kylie Davies (Masters Candidate) or Laura-Clare Whelan (Research Nurse – Starship Hospital).

Voluntary participation and your right to refuse:

It is important for you to know that involvement in the research project is voluntary. If, after agreeing to participate in the research you later change your mind, you may withdraw your consent at any time; simply by informing the researcher (see below for contact number or e-mail address).

What are the aims of this study?

The aim of this study is to develop an Endotracheal Suction Assessment Tool (ESAT) based on data obtained from the Respiratory Assessment Questionnaire. The ESAT will provide evidence based practice as a guide for nursing practice within Paediatric Intensive Care (PIC) to improve patient care.

Who is doing this study?

The principle researcher is Kylie Davies a Clinical Nurse working at Princess Margaret Children’s Hospital (PMH), in the Paediatric Intensive Care Unit. The study is being conducted as part of her Masters of Nursing Research. Associate Professor Leanne Monterosso from PMH and Edith Cowan University (ECU) will be the researcher’s supervisor.

Laura-Clare Whelan, the Research Nurse at Starships paediatric intensive care unit, is assisting in distribution of the questionnaire in New Zealand.

Why have I been chosen?

Nurses with five or more years of experience working in PICU and/or who have a postgraduate certificate in paediatric intensive care will be asked to complete the questionnaire, as they meet the selection criteria. Nurses from Australian and New Zealand paediatric intensive care units who meet the selection criteria are being asked to complete the questionnaire.

What will be expected of you?

If you decide to participate in this study, you need to complete the enclosed questionnaire and return it in the pre-paid envelop. The questionnaire is in three parts. The first contains questions about demographic information. The second part requires you to firstly identify how often you use specific criteria in determining if your patient requires endotracheal (ETT) suction through marking a cross along a scale. The second component of part two requires you to rate the importance of each criteria by marking a cross along a scale.

The third section involves questions about your clinical practice in relation to ETT suction. The aim is to identify any criteria you use in determining if ETT suction is required that has not been identified in the previous section. Please return these documents in the reply paid envelope. The questionnaire should take no longer than 30 minutes to complete. You have 2 weeks to complete & return the questionnaire.

Thank you for consenting to take the time to complete the attached endotracheal suctioning questionnaire. Please find enclosed a tea bag to drink whilst you complete the questionnaire.

How will your privacy be protected?

To protect your privacy and keep your personal details confidential the following steps will be taken:

1. Each hospital contacted for the research will provide a name of either the Clinical Nurse Manager of the PICU area or Nurse Researcher for the area to identify nursing personnel who meet the selection criteria.
2. The questionnaire will be sent to you in a sealed envelope.

The questionnaire will be completely anonymous with no identifying names or code numbers.

3. Coding of the questionnaire will occur on return of the questionnaire by the researcher only.
4. The coded questionnaires and information-identifying participants will be kept separately and no third party is involved in collecting the data once the questionnaire is completed to ensure confidentiality. All information on the coding will be kept under lock & key at Edith Cowan University (ECU) with the researcher and her supervisor only having access.
5. The data will be destroyed 10 years after publication.
6. You will not be identified in any way to the researcher's supervisor either during the study, or in reports published following completion of the study.

Are there any risks involved in the study?

There are no known risks to you in this study. If, however, your participation raises questions or concerns that you wish to discuss with the researcher, please contact Kylie Davies (see below) and she will be happy to address any concerns or questions you have. For New Zealand participants Laura-Clare Whelan may also be contacted.

Who has given permission for this study to proceed?

The ECU Human Research Ethics Committee has approved this research project.

The Women's and Children's Hospital in Perth, Western Australia's Ethics Committee has given consent for the pilot testing of the questionnaire.

Australian participants are contacted through the use of the Australian College of Critical Care Nurses database. Consent to conduct the research in New Zealand has been approved by The Northern Y Regional Ethics Committee which reviews application for research within your hospitals area. The Director of Nursing for your hospital has given permission for this study to be carried out.

If you have any concerns or complaints about the project and wish to talk to an independent person, please contact the Research Ethics Officer, ECU Human Research Ethics Committee, Phone (08) 6304 2170 or Email

research.ethics@ecu.edu.au or

If you have any queries or concerns regarding your rights as a New Zealand participant in this study you may wish to contact a Health and Disability Advocate, telephone

- North Island 0800 42 36 38 (4 ADNET)
- Free Fax (NZ wide) 0800 2787 7678 (0800 2 SUPPORT)
- Email (NZ wide) advocacy@hdc.org.nz

Who can you contact if you have questions about the study?

Kylie Davies:

E-mail – Kylie.Davies@health.wa.gov.au or

Phone – [REDACTED] or

Laura-Clare Whelan

Research Nurse
Paediatric Intensive Care Unit
Starship Children's Hospital
LCWhelan@adhb.govt.nz

(649) 3074949; extension 23070

or

Supervisors Name: Dr Leanne Monterosso

Associate Professor of Paediatric Healthcare

School of Nursing, Midwifery and Postgraduate Medicine

Edith Cowan University

Ph: 08 9273 8621 (International callers replace 08 with 61 8) or

Ethic Committee at Edith Cowan University: research.ethics@ecu.edu.au

THANK YOU AGAIN FOR YOUR PARTICIPATION.

APPENDIX 16

Kia ora Kylie, apologies for the time taken to respond. I am happy to support your proposed research. There are ADHB policies and processes which you will also need to comply with if you wish to undertake research in Starship. These policies apply to all researchers. Can I suggest you contact Gayl Humphry from our Research Office to formalise this approval. Good luck, Taima

Email received: 02/04/07 @ 3.04pm from Ms Taima Campbell Director of
Nursing at Starship Hospital New Zealand.

APPENDIX 17

ENDOTRACHEAL SUCTIONING QUESTIONNAIRE

Section 1 Demographic Information

Code Number:

1. Designation:

RN ☐ CN ☐ CNS ☐ Other (please state)

2. Age: _____ years.

3. Gender: Male ☐ Female ☐

4 Number of years of experience working in Paediatric Intensive/Critical Care:

5 Experience in other Critical Care areas (please tick which is appropriate & write the number of years experience in these areas)

1. Neonatal Intensive Care	<input type="checkbox"/>	Number of Years	_____
2. Adult Intensive Care	<input type="checkbox"/>	Number of Years	_____
3. Coronary Care	<input type="checkbox"/>	Number of Years	_____

6. Have you completed post-graduate qualifications in any of the following specialities? (please tick all that apply):

Neonatal Intensive Care	Yes	<input type="checkbox"/>	No	<input type="checkbox"/>
Paediatric Intensive Care	Yes	<input type="checkbox"/>	No	<input type="checkbox"/>
Adult/Coronary Care Intensive Care	Yes	<input type="checkbox"/>	No	<input type="checkbox"/>

7. Please state the name of the hospital in which you are currently employed.

Section 2 Criteria on ETT Suctioning

8) Respiratory Assessment Criteria

For each of the following criteria please **mark an 'x' on the line** at the point that best shows how often you use the criteria when determining if endotracheal suction is required.

For example: How often do you use *the criteria of the patient's weight* before determining whether to give pressure area care? (The x indicates that this criteria is seldom used).

Not at all	_____	Always
------------	-------	--------

a. Dyspnoea or signs of respiratory distress.

Not at all _____ Always

b. Auscultation: (altered, diminished, abnormal air entry).

Not at all _____ Always

c. Decreased oxygen saturation/cyanosis.

Not at all _____ Always

d. Visible or audible secretions.

Not at all _____ Always

e. Coughing.

Not at all _____ Always

f. Altered chest movement.

Not at all _____ Always

g. Suspected aspiration.

Not at all _____ Always

h. Haemodynamics (unexplained changes in heart rate/BP & ICP if applicable).

Not at all _____ Always

i. Alteration in arterial blood gas results.

Not at all _____ Always

j. Decreased tidal volume delivery.

Not at all _____ Always

k. Increasing end tidal CO₂.

Not at all _____ Always

l. Increased peak pressure.

Not at all _____ Always

m. Unexplained patient restlessness.

Not at all _____ Always

n. Suspected obstruction of the endotracheal tube by secretions.

Not at all _____ Always

o. Frequency of endotracheal tube suction is set by unit protocol/guidelines.

Not at all _____ Always

9) To rate the importance of each respiratory assessment criteria **please mark an 'x' on the line** at the point that best shows how important you believe that criteria is when determining whether to perform suction.

For example: How important do you consider *the criteria of a patient's weight* before determining whether to give pressure area care? (The x indicates that this criteria is not very important).

Not at all important	_____ X _____	Very Important
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a. Dyspnoea or signs of respiratory distress.

Not at all important _____ Very Important

b. Auscultation: (altered, diminished, abnormal air entry).

Not at all important _____ Very Important

c. Decreased oxygen saturation/cyanosis.

Not at all important _____ *Very Important*

d. Visible or audible secretions.

Not at all important _____ *Very Important*

e. Coughing.

Not at all important _____ *Very Important*

f. Altered chest movement.

Not at all important _____ *Very Important*

g. Suspected aspiration.

Not at all important _____ *Very Important*

h. Haemodynamics (unexplained changes in heart rate/BP & ICP if applicable).

Not at all important _____ *Very Important*

i. Alteration in arterial blood gas results.

Not at all important _____ *Very Important*

j. Decreased tidal volume delivery.

Not at all important _____ *Very Important*

k. Increasing end tidal CO₂.

Not at all important _____ *Very Important*

l. Increased peak pressure.

Not at all important _____ *Very Important*

m. Unexplained patient restlessness.

Not at all important _____ *Very Important*

n. Suspected obstruction of the endotracheal tube by secretions.

Not at all _____ Always

o. Frequency of endotracheal tube suction is set by unit protocol/guidelines.

Not at all _____ Always

10. For the following questions, if more space is required to write your answers please use a separate sheet and attach it to the back of this questionnaire – Thank you.

a Describe as fully as possible a recent ETT suction experience you performed. Include in your description the specific factors that influenced your decision to perform endotracheal suction for this patient.

b What criteria (other than you have described above) do you personally consider when determining if a child requires endotracheal suction? (e.g. alteration in the pressure curve on the graphic display of the ventilator).

Thank you for taking the time to complete this form – please enclose within the attached envelope for return.

APPENDIX 18



Northern Y Regional Ethics Committee

Ministry of Health
3rd Floor, BNZ Building
354 Victoria Street
PO Box 1031
Hamilton
Phone (07) 858 7021
Fax (07) 858 7070

16 March 2007

Kylie Davies



Dear Kylie

Determining standard criteria for endotracheal suction in the paediatric intensive care patient: a Descriptive Survey.

Investigators: **Kylie Davies, Laura-Clare Whelan.**

Ethics ref: **NTY/06/12/127**

Locations: **Starship Hospital.**

The above study has been given ethical approval by the **Northern Y Regional Ethics Committee.**

Approved Documents

- Information sheet for Participants received 23/02/07.
- Covering letter for Directors of Nursing.
- Outline of study for Directors of Nursing.
- Consent Form for Directors of Nursing.
- Endotracheal Suctioning Questionnaire.

Accreditation

The Committee involved in the approval of this study is accredited by the Health Research Council and is constituted and operates in accordance with the Operational Standard for Ethics Committees, April 2006.

Final Report

The study is approved until **30 August 2007**. A final report is required at the end of the study and a form to assist with this is available from the Administrator. If the study will not be completed as advised, please forward a progress report and an application for extension of ethical approval one month before the above date. Report forms are available from the administrator.

Amendments

It is also a condition of approval that the Committee is advised of any adverse events, if the study does not commence, or the study is altered in any way, including all documentation eg advertisements, letters to prospective participants.

Please quote the above ethics committee reference number in all correspondence.

It should be noted that Ethics Committee approval does not imply any resource commitment or administrative facilitation by any healthcare provider within whose facility the research is to be carried out. Where applicable, authority for this must be obtained separately from the appropriate manager within the organisation.

Yours sincerely

Amrita Kuruvilla
Northern Y Ethics Committee Administrator

Email: amrita_kuruvilla@moh.govt.nz